DEVELOPING A STATE WATER QUALITY TRADING FRAMEWORK IN GEORGIA: STRUCTURES, COMPONENTS, AND POLICY CONSIDERATIONS

by

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(Under the Direction of James E. Kundell, Ph.D.)

ABSTRACT

The Federal Clean Water Act Amendments of 1972 (CWA) initiated an effort to protect and improve surface water quality. Despite improvements nationwide, numerous waters still do not fully support some designated use, including many in Georgia. To address these short-comings, additional management alternatives must be considered. Water quality trading (WQT) is one option that uses market-based forces to encourage reductions and enables sources to choose least-cost compliance alternatives. The theoretical benefit is a net reduction of pollution within watersheds at lower total costs. The popularity of WQT is growing in Georgia and it may become a viable management tool in the future. Thus, adequate consideration of the critical policy components is necessary for appropriate utilization. This thesis analyzes trading frameworks of seven states to identify specific alternatives that may be applicable to Georgia's environmental, economic, and legal contexts. Recommendations for developing an appropriate policy framework in Georgia are provided.

INDEX WORDS: Clean Water Act, Environmental Protection Agency, Georgia Environmental Protection Division, Market-based mechanisms, Water policy, Water pollution, Water quality trading, Watersheds

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LIST OF ACRONYMS

BMP: Best Management Practice

CDEP: Connecticut Department of Environmental Protection

CWA: Clean Water Act

CWQCD: Colorado Water Quality Control Division

GEPD: Georgia Environmental Protection Division

IDEQ: Idaho Department of Environmental Quality

IMD: Internal Management Directive

MDEQ: Michigan Department of Environmental Quality

NPDES: National Pollutant Discharge Elimination System

NRCS: Natural Resource Conservation Service

ODEQ: Oregon Department of Environmental Quality

OEPA: Ohio Environmental Protection Agency

ONRW: Outstanding Natural Resource Water

PDEP: Pennsylvania Department of Environmental Protection

POTW: Publicly-owned Treatment Works

TMDL: Total Maximum Daily Load

USEPA: United States Environmental Protection Agency

WQT: Water Quality Trading

WWTF: Wastewater Treatment Facility

CHAPTER 1

INTRODUCTION

Clean water resources are essential for sustaining human and ecosystem health as well as economic activity. Protecting the quality of water resources has been difficult, though, as growing populations and industry have utilized water bodies for inexpensive waste disposal. In 1972, the United States officially acknowledged the importance of protecting and improving the nation's waters through passage of the Federal Water Pollution Control Act Amendments (33 U.S.C. 1251 et seq.). Later known as the Clean Water Act (CWA), this piece of legislation initiated a nationwide effort to establish quality standards for designated uses of surface waters, document pollutant impairments to those uses, and implement strategies to ensure appropriate quality attainment.

The primary mechanism employed to improve water quality was the National Pollutant Discharge Elimination System (NPDES)[1], which is a permitting system that regulates point source dischargers such as industrial and municipal wastewater treatment facilities. Regulated sources are legally bound to meet effluent limitations defined in their permits and are responsible for improving their effluent quality should permit limitations be lowered. In order to comply with limits, point sources have traditionally relied upon technology-based or operational modifications. This system has been instrumental in achieving significant pollution reductions across the country since its inception (Greenhalgh and Faeth, 2001; GEPD, 2002b).

[1] Section 402(b) of the federal Clean Water Act authorizes states to administer an NPDES permit program if minimum federal standards are met (USEPA, 2005a). Permits may include some variation of technology-based effluent limitations, but must include water quality-based effluent limitations if the technology-based limits are not sufficient to achieve defined water quality standards (Hecox, E., Date Unknown (a)).

Clean Water Act Implementation Failures

Despite measurable progress from the NPDES program in reducing point source pollution, nearly half of all surface waters assessed in the United States still exhibited some level of impairment by the year 2000 (USEPA, 2003a). Georgia has not been immune to such problems either. According to the most recently finalized Georgia 305(b) Report (GEPD, 2002b)[2], more than half of the stream mileage, approximately 28 percent of lake acreage, and more than 12 percent of estuarial square mileage surveyed between 2000 and 2001 did not fully support some designated use (see Figure 1). These figures denote significant failures of the current regulatory methodology and elicit various concerns over the actual causes of quality impairment. Many water quality managers and researchers, including those in Georgia, point to two key issues: increased demand for point source discharges and extensively unregulated non-point source loadings (GEPD, 2002b; Landry, 2002; USEPA, 2003b; Podar and Kashmanian, 1998).

Balancing fully allocated assimilative capacities with the demands of growing populations and economic activity has required regulators to impose stricter standards on the quality of point source effluent. Increased effluent standards lead to expensive compliance costs. Although creating technology-based reductions may not be overly expensive for many point sources at present, meeting more stringent effluent limitations in the future could prove to be cost-prohibitive (Rowles, 2005). In addition to high implementation costs, the effectiveness of the current regulatory approach is limited due to a narrow focus on a single portion of total pollutant contributions (Greenhalgh and Faeth, 2001). Point sources, then, are subjected to an expensive and unequal burden of supplying major pollution reductions.

[2] Section 305(b) of the Federal Clean Water Act requires each state to prepare a biennial report on quality conditions of navigable surface waters within the state (GEPD, 2002b).

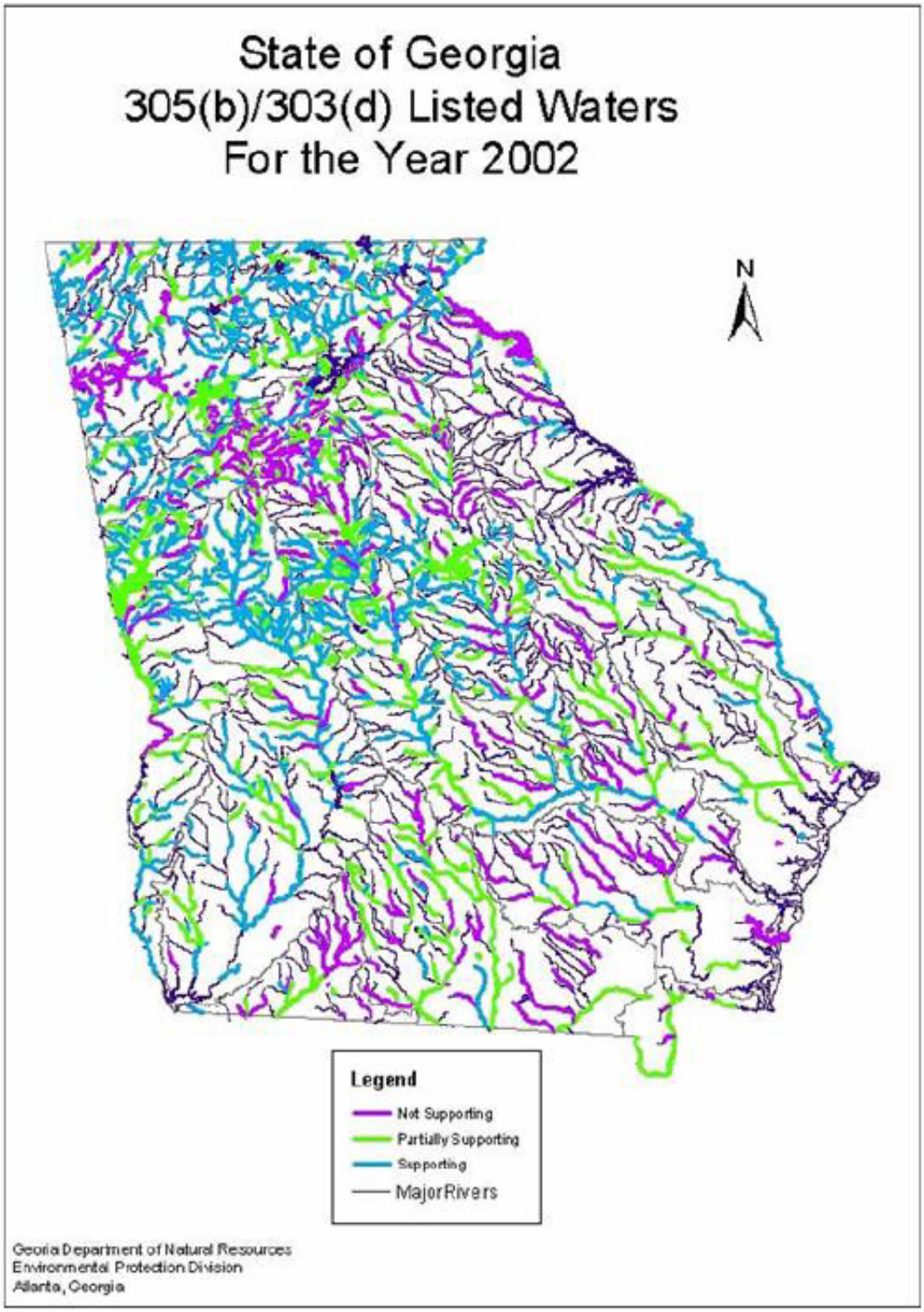

Figure 1. IMPAIRED WATERS OF GEORGIA, 2002
(GEPD, 2002a)

A greater imposition on water quality is non-point source pollution, which results from precipitation collecting contaminants as it moves across the landscape and enters a body of water (USEPA, 2003b). Non-point sources—as the title implies—lack an easily recognizable location of origin and are subject to spatial, temporal, and intensity variations. Collective anthropogenic behaviors lead to excessive loadings of nutrients, sediments and other contaminants. Unlike point source pollution, which is discrete and measurable, non-point source pollution is diffuse and difficult to quantify. Thus, problems in clearly identifying responsible parties or exact loadings have thwarted traditional regulatory methods and have allowed non-point sources to evade serious regulatory attention (Faeth, 2000; Greenhalgh and Faeth, 2001; Podar and Kashmanian, 1998).

Georgia faces growing constraints in attaining water quality standards as mandated limits are more strongly enforced and demand for assimilative capacity use rises. Achieving cost-effective point source reductions and effectively controlling non-point source contributions will be imperative to attaining statutory goals, but may prove more difficult using narrowly focused regulations. Fortunately, practical alternatives do exist that address the short-comings of conventional regulatory methods.

Addressing Failures with Market-based Alternatives

Failures to achieve CWA goals include a lack of viable point source treatment technologies and inadequate control of non-point source pollution. Mechanisms to enforce regulatory standards are often limited to non-compliance fines for NPDES permit holders. If adequate technology does not exist or is too expensive to develop, permit holders may opt to pay the less expensive fees, further thwarting attainment of CWA goals (King, 2005). Other

regulatory mechanisms that encourage technological innovation and proactive reductions are necessary to address pressing water quality issues.

Market-based mechanisms take advantage of systems that create economic incentives to generate pollution reductions and constitute one set of positive-motivation alternatives. Water quality trading (WQT), in particular, is a prominent market-based mechanism modeled after the successful federal air emissions trading program and has been implemented in many American watersheds for over a decade (Woodward et al., 2002). This method operates on a water segment to watershed scale and allows pollution sources within those boundaries to select from a range of least-cost options for meeting mandatory reductions.

The impetus for such a system arises when a pollution reduction target is established by regulators such as the U.S. Environmental Protection Agency (USEPA) or equivalent state agency. Market systems function on the exchange of established pollution credits that are created when a source is able to reduce pollutant discharges in excess of its legally required target and has substantially lower reduction costs than other polluters within the same watershed. These credits, or rights to discharge certain amounts of pollutants, are then sold to a second polluter at a cheaper rate than the purchasing source can reduce their own discharge levels through conventional methods. The purchase of credits may enable the buyer to meet their regulatory limit at a significantly lower cost while also creating a net reduction of pollution within the watershed (USEPA, 2004c).

Similar to the credit trading principle, Shabman et al. (2002) describe an "allowance market" that further enables sources to select desirable methods for complying with their pollutant allocation. While credit trading involves exchanges of allocation proportions to enable one source to discharge beyond its limit, allowance markets focus on the flexibility provided to

dischargers to control their contributions with whichever methods are most suitable and cost-effective. Options may include decreasing discharge volume or abating various non-point sources within the same watershed. Despite some discrepancies, both market forms create reduction alternatives for sources that might otherwise be restricted to instituting technology-based reductions. Throughout the remainder of this thesis, the two trading concepts will be considered synonymous with one another and the freedom of sources to make trades with any equivalent pollution producer is assumed.

In addition to helping achieve regulatory compliance, WQT may be a valuable tool for enabling future economic growth in fully allocated watersheds. Currently, watersheds that entirely utilize their assimilative capacities are faced with moratoria or other strict inhibitions to economic development. Trading provides new or expanding sources an opportunity to "buy into" a total waste load allocation; thus, facilitating continued economic growth and increasing the allocation efficiency.

Finally, it is important to make clear that a few key elements must be in place for WQT markets of any kind to exist and operate. These elements include, but are not limited to the following.

- **Regulatory catalyst**: A regulatory limit must be defined and enforced to encourage sources to make reductions. This is to say that WQT markets "would complement – not replace – current regulatory programs" (Taff and Senjem, 1996) in order to meet water quality goals. Limits can include Total Maximum Daily Loads[3] or other water body-

[3] Section 303(d) of the Federal Clean Water Act requires the development of Total Maximum Daily Loads (TMDL) for all waters still impaired after implementation of technology-based effluent limitations (Hecox, E., Date Unknown (b)). A TMDL allocates the total allowed pollutant load between sources within the same designated

specific standard set by local, state, or federal authorities. Within a regulatory limit, the characteristics of point source and non-point source allocations will significantly influence who generates credits and how many.

- **Variable reduction costs**: Sources discharging analogous pollutants to the same water segment or watershed must have disproportionate reduction costs to create supply and demand functions. An economic incentive to produce, or supply, credits is formed when sources can cost-effectively adopt new technology; implement Best Management Practices (BMPs) for non-point sources; or simply obtain benefits from economies of scale using current treatment technology. Demand for reduction alternatives occurs when other sources have some economic inhibition to employing similar methods (USEPA, 2004c).

- **Unrestrictive transaction costs:** Credit transactions must be less expensive than making technology-based reductions for some sources yet provide sufficient returns for those that do. Credit trading entails the cost of exchanged credits plus the additional costs of conducting business. These expenses, or transaction costs, can arise from various sources such as obtaining necessary information, bargaining and decision-making, and monitoring and enforcement (Stavins, 1995). In addition to limitations created by legal and institutional structures, the characteristics of the pollutant subject to exchange and the selected market design play an integral role in transaction cost variability. Transaction costs often make the difference between incentives and disincentives to trade.

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hydrologic unit. Multiple impaired water segments within the same geographic region may be included in a single TMDL.

- **Environmental efficacy**: To ensure water quality goals are met, trades should be conducted so that no diminution of local water quality occurs and/or a net reduction of pollution is achieved (USEPA, 2005b). This element, above all others, is the most critical because it embodies the primary incentive behind all pollution control efforts, both conventional and market-based.

Market Considerations and Federal Guidance

Policy design can strongly influence the attractiveness of trading options to pollution sources as well as influence the long-term efficacy of trading markets. The following section discusses important trading issues identified by the USEPA and other researchers that should be considered during trading program development.

In 2003, USEPA's Office of Water released the Water Quality Trading Policy (USEPA, 2003a) in order to encourage the development and implementation of "trading programs for nutrients, sediments and other pollutants where opportunities exist to achieve water quality improvements at reduced costs" (p. 2). Although the policy does not carry the weight of law, it does outline the essential components necessary for trading activities to be compatible with legally binding CWA provisions. Important components of the policy include a list of pollutants generally suitable for trade, circumstances when and where trading may commence, requirements for CWA compliance, suggestions for creating "credible" trading programs, and a description of USEPA's oversight responsibilities.

The pollutants most suitable for trade are nitrogen, phosphorus and sediments and cross-pollutant trades may be allowed under certain circumstances to address oxygen-related impairments. Trading of these substances necessitates the establishment of baselines from which

excess reductions, or credits, can be determined. Examples of baselines where no TMDLs are in place include NPDES permit limits for point sources and currently mandated land-use management practices required for non-point sources. Where TMDLs exist, waste load and load allocations may serve as baselines for point and non-point sources, respectively. Likewise, transactions should only occur within a distinct watershed or other TMDL-defined boundary. USEPA does not support trading of persistent bioaccumulative toxics or trades that are meant to comply with technology-based effluent limitations[4]. The exception to technology-based prohibitions includes some intra-plant trading of conventional and toxic pollutants for the iron and steel industry (PDEP, 2003).

Greenhalgh and Faeth (2001) describe two common trading scenarios that are further supported by the USEPA Trading Policy. "Open trading" occurs when trades are utilized in watersheds with no previously established regulatory limit. Conversely, "closed trading" occurs in watersheds with defined pollution caps and is the most common type of trading. Despite a divergence from articulated economic and regulatory principles in the previous section, the USEPA suggests "open trading" may take place in non-impaired waters to help maintain current standards or in pre-TMDL impaired waters to facilitate water quality standard obtainment. Protecting social values of clean water and avoiding the issuance of legally binding TMDL allocations would become the driving force behind these efforts in lieu of regulatory compliance.

Nevertheless, based on the widely-accepted utility maximization theory, the most likely scenario for which firms will participate in trading is still under the auspices of a TMDL or other mandated water quality limitation. This theory suggests that firms have a greater economic incentive to discharge the maximum level of allowed pollution for the maximum amount of time

[4] Technology-based limitations are the minimum treatment requirements written in NPDES permits (Hecox, E., Date Unknown (a)). These are not established with specific regard to the ambient quality effects to the receiving water.

than they do to invest in reductions for the public welfare or to avoid further regulations. The federal policy explicitly states that once a TMDL has been established, no trading activity should transpire that would thwart its implementation or result in a breach of the defined limitations. Lastly, USEPA supports pre-treatment[5] trading between municipal sewerage authorities and industrial sewerage systems as well as intra-plant trading for individual sources with multiple discharge points to the same water body. Such trades will most likely require modifications of individual NPDES permits.

Trading activities must, of course, be consistent with CWA directives. The federal policy discusses several issues that should be considered to ensure trading under each of the aforementioned scenarios is legally viable. These include the following.

- **Requirements to obtain permits:** Firms must properly obtain all applicable permits as required by CWA §402 and 404 before participating in trading activities.

- **Incorporating provisions for trading into permits:** The U.S. Environmental Protection Agency maintains that inclusion of trading provisions in NPDES permits will increase the flexibility of sources to make choices in addition to clarifying acceptable trading terms and actions.

[5] Pursuant to 40 C.F.R. §403.10(a), states must develop a pretreatment program in order to administer an NPDES permitting program. Pretreatment programs define which pollutants are prohibited from being delivered to Publicly Owned Treatment Works (POTW) from industrial facilities (USEPA, 1999). Since facilities are required, at a minimum, to remove the prohibited pollutants, pre-treatment trading will most likely involve credit exchanges between NPDES permitted POTWs and the facilities that deliver pretreated effluent to them.

- **Public notice, comment and opportunity for hearing:** The CWA requires public notice, comment and opportunity for hearing to be provided before issuance of an NPDES permit. The USEPA recommends that notices of permit issuance include information regarding trade provisions; explanations of how baselines will be established; and how trading will help obtain water quality goals. From this inclusion, USEPA believes challenges to trading activities will not arise on a trade-by-trade basis, but rather at the time a permit is issued.

- **Consistency with standard methods:** Methods and procedures such as sampling and monitoring techniques currently required by law should continue to be utilized in order to ensure consistency across all implementation and enforcement efforts.

- **Protecting designated uses:** Trades that impair existing or designated uses, harm a drinking water supply, or breach TMDL-defined limitations are not supported by the USEPA. This would typically involve a trade which allows a source to increase its effluent load. If this required an NPDES permit modification, sources would be subject to antibacksliding and antidegradation provisions (see below). Furthermore, the CWA prohibits trades that lead to a localized diminution of water quality, often referred to as "hot-spots" (USEPA, 2005b), even if such activity results in a net reduction to the watershed. If a point source purchases credits to maintain the level of effluent previously defined in its permit, then it should not create a "hot-spot." Furthermore, upper limits for effluent volume or concentration may be defined within an NPDES permit as an added measure of protection (IDEQ, 2003).

- **Antibacksliding**: Section 402(o) of the federal Clean Water Act prohibits the inclusion of less stringent effluent limitations in a source's NPDES permit renewal, reissue, or modification except under certain circumstances. More specifically, USEPA believes antibacksliding as defined in §303(d)(4)[6] will not occur if sources increase their discharge using credits generated in accordance with accepted water quality based effluent limitations or if a source currently making reductions below a water quality based effluent limitation decides to cease credit production in the future. Some states may have provisions within their own antibacksliding policies that allow a renewed or modified NPDES permit to contain a less stringent effluent limitation under certain circumstances. When less stringent limitations are not allowed for new or increased discharges, offset requirements incorporated into NPDES permits may be warranted in order for a source to comply with applicable antibacksliding requirements.

- **Antidegredation:** Each state must develop an antidegradation policy, which establishes limitations for the lowering of quality in waters that currently support designated uses (USEPA, 2004b). The federal antidegradation policy allows states to grant variances to this standard when "necessary to accommodate important social or economic development" (40 C.F.R. 131.12(2)). States must, at a minimum, maintain levels of quality necessary to protect existing instream water uses. The most stringent requirement of the federal regulation is the protection of waters that qualify as outstanding national resources. The quality of these waters and any similar designated state waters is to be protected at current levels (Hecox, E., Date Unknown (b)). Since trades should generally

[6] Section 303(d)(4) of the federal Clean Water Act generally prohibits the renewal, reissue, or modification of an NPDES permit to include a less stringent effluent limitation which violates an applicable water quality standard.

not result in a lowering of water quality or a net increase of pollution, the USEPA trading policy recommends that state antidegradation policies not require full antidegradation reviews for individual trades within high quality waters. Nevertheless, determinations of water quality trading appropriateness must pay special regard to antidegradation policies of states with various levels of protection for designated waters.

The trading policy also proposes seven elements that should be built into a trading program for it to be "credible." The first recommendation begins by reinforcing the fact that the CWA provides clear and sufficient legal authority for trading and as a result of this authority suggests "states and tribes should use specific legal mechanisms to facilitate trading" such as "legislation, rule making, incorporating provisions for trading into NPDES permits and…provisions for trading in TMDLs or watershed plans" (p. 8).

The next set of recommendations advise programs to specifically address methods for defining units of trade and quantifying credits as well as determine the appropriate timing of credit generation and use. Units of trade can be in rates or mass per unit time and "credits should be generated before or during the same period they are used" (p. 8). The policy describes in further detail options for dealing with the uncertainty associated with quantifying non-point loadings and reductions. Some suggested methods include utilizing trade ratios between point and non-point sources, using previously demonstrated performance values of BMPs, retiring a certain percentage of reductions and creating credit reserve-pools to draw from in the case of abatement failures. The use of appropriate loading models, conservative assumptions, and USEPA consultation should produce workable solutions for addressing non-point source uncertainty.

The last three recommendations describe methods for ensuring that sources are performing as expected and that trading programs are as environmentally effective as intended. The USEPA recommends trading programs include practical mechanisms that facilitate compliance and enforcement such as record keeping, monitoring, reporting and inspections. Furthermore, explicitly defined participant responsibilities should be included to reinforce the obligation of traders to make necessary and agreed upon reductions. Both buyers and sellers should be fully informed of their responsibilities as well as the level and duration of their liability. To increase the transparency of trading activities and to increase the robustness of trading markets, USEPA recommends that relevant information be openly accessible to the public. One potential method for providing accessible information is *via* the World Wide Web, which is an inexpensive and easily updateable mode of communication. The USEPA predicts this will help identify potential trade participants, reduce transaction costs and increase public credibility. The final policy recommendation is to incorporate some method for program evaluation. This not only necessitates an environmental performance evaluation, but also a process for program refinement.

The final component of the federal trading policy describes USEPA's oversight role in trading initiatives. Since many states have taken over most CWA enforcement responsibilities, USEPA's role should be minimal. However, the policy affirms that if some question is raised over the efficacy or legality of a trading program, the agency will assert its legal authority to enforce CWA provisions.

In addition to establishing legal parameters and ensuring environmental efficacy, trading policies can have a significant impact on market functions. Thorough consideration should be given to the design of trading policies in order to boost the potential of markets to function

optimally. Chosen parameters and market structures greatly influence who participates in trading and the level of cost-effectiveness each participant is able to gain. The first component that must be addressed is what types of trades will be allowed. The availability of point and non-point source trade alternatives increases the flexibility of participants and will most likely extend the margin of buyer cost-savings (Taff and Senjem, 1996). However, difficulties in quantifying non-point source loadings and reductions create uncertainties in trade equivalency. Thus, the inclusion of non-point sources in a market requires some corrective method such as trading ratios or reserve pools to address uncertainties. Secondly, market structures—either facilitated or overseen through state policy—largely determine the efficiency of market operations. The selection of a market structure should hinge upon the specific pollution problems being addressed, the expected trading participants, and their reasonably foreseeable transaction costs. Woodward et al. (2002) identify four market structures and explain how each will affect transaction costs. The following are summaries of the structures described by Woodward and his colleagues.

- **Exchanges:** Credits are uniform in price and quality. Information regarding credits is easily accessible to the public as well as those involved in potential trades allowing for efficient and low cost transactions;

- **Bilateral negotiations:** Terms of a trade are privately negotiated and information is directly exchanged between buyer and seller. This system typically has higher transaction costs and is more ideal for situations with non-uniform credits.

- **Clearinghouses:** Credits of varying price and quality are bought from multiple sources, converted into a uniform product and then sold at a standardized price. The need to search for credits and exchange information between buyers and multiple sellers is eliminated resulting in lower transaction costs.

- **Sole-source offsets:** Involves a single entity that is allowed to meet water quality standards at one site if pollution is reduced at a different site. No actual trading occurs, but this structure provides a viable alternative for entities that can reduce pollution loads more cheaply at one site than at another.

Since stakeholder needs will vary greatly across the state, criteria for what represents an appropriate or best market structure will vary too. Implementation of trading policies or programs at the state-level will most likely fall into one of three categories: 1) a state-managed clearinghouse, 2) governance of individual initiatives resembling any of the three remaining market types, or 3) a combination of the two. Thus, the initial decision that must be made before drafting any state policy is whether the state intends to actively utilize WQT as a management tool or whether it simply intends to manage the future implementation of trading. Certainly, such decisions determine the presence or absence of attractive, low-cost incentives and ultimately allocate market operating costs between the state and market participants. While decisions of market structures are important to trading feasibility and efficiency, state regulators are principally responsible for ensuring that markets produce legally-compliant and environmentally-effective trades at a minimum.

Furthermore, it is necessary to separate-out the difference between markets in general and state policies. These concepts may overlap where state policies entail some form of state-facilitated market. What should remain clear is that these markets are only a subset of policy alternatives. State policies themselves, no matter how complex, have more straightforward objectives. Rowles (2004) presents a concept developed by the USEPA, which consists of eight essential functions of WQT market institutions. These functions include:

- Define marketable reductions; *
- Communicate among buyers and sellers;
- Ensure environmental equivalence;*
- Define and execute trading process;*
- Track trades;
- Assure compliance with relevant federal, state, and local requirements;*
- Manage risk among parties to trades;* and
- Provide information to stakeholders.* (p.50)

With some exception, these functions can also be applied to a state trading policy framework. The items emphasized by an asterisk represent the broader functions of a framework while the other points represent additional functions more commonly associated with a specific market institution. These emphasized points will serve as guiding principles for developing policy recommendations in the following chapters of this thesis.

Relevance of Study

Use of water quality trading is a rapidly growing trend in watersheds throughout the country. In 2004, over 70 trading initiatives were identified in the United States (Breetz et al.). Trading has also occurred informally in some Georgia counties despite the absence of official trading rules, regulations, or policies. Public wastewater treatment facilities in Chatham, Cherokee, and Cobb counties have utilized trading in efforts to redistribute waste load allocations among static and dynamic sections of growing communities (S. Salter, electronic communication, March 14, 2005).

As demonstrated above, WQT has the potential to incite proactive pollution reductions, offer sources cost-effective alternatives for regulatory compliance, and facilitate future economic growth. It may be a viable and highly sought after option for meeting quality goals in watersheds throughout Georgia within the near- and long-term futures. Thus, the Georgia policy-makers have a responsibility to manage the employment of this complex, yet helpful compliance mechanism.

Purpose of Study

State policies that govern WQT can have a profound impact on how optimally markets operate and to what extent trades improve water quality. Proactive considerations of the influential policy components are necessary before such activity formally commences. While this thesis refrains from conducting an environmental or economic analysis *per se*, the importance of such analyses for the success of markets cannot be overemphasized. Indeed, individual assessments must be made to determine whether trading would help achieve water quality goals within a certain watershed and to identify potential constraints on market vitality.

Guidance for conducting watershed and market-feasibility analyses can be found in USEPA's *Water Quality Trading Assessment Handbook* (2004a) and in working papers drafted by other Georgia researchers such as Jiang et al. (2005) and Rowles (2005). These reports expound upon important trading criteria such as environmental suitability, regulatory and economic incentives, and market robustness in relation to available participants.

The definitive goal of this study, then, is not to determine when and where WQT would work best, but rather to determine how a Georgia trading policy framework can be crafted to simultaneously enhance market-system efficiencies and achievement of mandated water quality goals. To pursue this thesis objective, state-level trading frameworks from across the United States are explored and discussed here to help inform future framework development in Georgia. Major concepts identified within the literature and examined policies are also utilized in an analysis of current legal and institutional structures of Georgia to determine the State's preparedness to implement an effective policy framework. Ultimately, it is hoped that future Georgia policy regarding water quality management, and WQT specifically, will directly benefit from the analyses, recommendations, and conclusions of this thesis.

Methodology

The following methods were employed to identify important WQT issues and determine Georgia's current ability to implement a trading policy.

- **A review of current literature regarding WQT theory, market structures, and historical implementation failures**. Relevant literature included periodical publications,

government reports, statutes, laws and regulations, and government agency and institutional websites were reviewed.

- **Analyses of laws, regulations, and policies of the federal government, Georgia, Colorado, Connecticut, Idaho, Michigan, Ohio, Oregon, and Pennsylvania were conducted for comparison**. The policy and legal components of each state were examined to help identify each policy alternatives relevant to a Georgia-specific context. Georgia policies and programs were reviewed to determine if they currently support or inhibit WQT (based on key principles from the literature and other policies) and to verify whether they adhere to federal trading policies. The seven state models analyzed were selected based upon the scope, the diversity of policy alternatives they present, and their applicability to the development of a state trading framework in Georgia. Other legal options are available for Georgia to explore, including rules for specific watershed programs such as those found in North Carolina's Neuse River Basin (NCDWQ, 2002) and Virginia's Chesapeake Bay (C.V. § 62.1-44.19:14 et seq.) or statutory authorization of pilot projects such as that found in Wisconsin's Fox-Wolf River, Red Cedar River and Rock River Basins (W.S. § 283.84). Numerous market and program design alternatives are also available for review in the extensive survey of trading initiatives conducted by Breetz et al. (2004) and Environomics (1999). However, these additional program models were not included in this thesis due to either their lack of state-level breadth or their lack of guidance for Georgia policy development.

- **Interviews with members of state regulatory agencies and individuals associated with specific trading programs.** The interviewees were specifically chosen based on their personal knowledge and experience with trading programs and/or policies.

Thesis Structure

The following sections of this manuscript will draw upon previously discussed concepts to assess Georgia's capacity to effectively facilitate WQT and suggest methods for developing a viable trading framework. Chapter two begins with a discussion of trading obstacles and proposed alternatives identified in literature. The remaining sections of the chapter outline the policy and legal trading mechanisms seven selected states have implemented on a statewide scale, including a description of common and unique elements. Chapter three presents an analysis of Georgia's environmental, legal, and institutional setting to highlight which policy alternatives identified from the literature and selected models may be relevant to the state. Potential strengths and weaknesses of Georgia's current regulatory framework are presented to identify changes necessary to effectively manage trading. Recommendations for developing a future trading framework in Georgia are discussed in chapter four. Finally, chapter five closes with a summary and conclusions from the research.

CHAPTER 2

LITERATURE AND STATE POLICY ANALYSES

A great sum of literature affords multiple perspectives on the issue of water quality trading. The majority of advocates for the concept are economists who tout the potential of marketable reductions to produce least-cost compliance alternatives (see Delmas and Marcus, 2004; Faeth, 2000; Greenhalgh and Faeth, 2001; Horan et al., 2001; Stavins, 1995; Taff and Senjem, 1996). However, most of these studies narrowly focus on specific aspects of theoretical markets, which are often free of realistic environmental and political variables or require the manipulation of rather immovable regulatory institutions. Another defining group of studies offers qualitative analyses of the numerous trading programs across the country. Since these analyses largely identify sub-optimal conditions common to the employment of trading in realistic situations, they tend to be less enthusiastic about its potential. Unfortunately, such authors often apply their criticisms to context-specific cases without providing constructive recommendations for improvement (see Fang and Easter, 2003; Hall and Howett; Horan et al., 2002; Jarvie and Solomon, 1998; O'Neil et al, 1983). Most importantly, what is lacking in the literature is empirical research that is useful across various complicated scenarios and informs broad framework development.

Theoretical Literature

Perhaps the most informative area of theoretical research for policy analysis relates to trading uncertainty; an inherent characteristic of WQT. Trades between point sources typically

entail less ambiguity since their discharges can be easily and accurately measured. Nevertheless, these trades can involve some level of variation due to watershed characteristics and pollutant-fate dynamics. More commonly, however, is uncertainty associated with trades between dissimilar sources (e.g., point/non-point source trades). Trading ratios are the conventional mechanisms for addressing the different types of uncertainty. Historically, ratios were established in proportions greater than 1:1 in order to provide for 1) the required level of pollution reduction, 2) a margin of safety against uncertainty, and 3) perhaps even a net water quality benefit (McGinnis, 2001). These types of ratios are established quite arbitrarily in nature and entail some level of uncertainty themselves. The tendency of public institutions to set ratios conservatively decreases the economic efficiency of trading (Horan, 2001) and immunizes the potential benefits of the management tool all together.

Stephenson et al. (1998) argue against the conventional wisdom, which implies non-point source reductions are inherently more ambiguous than point source reductions. Although point source effluent is easier to quantify at the end-of-pipe than diffuse non-point loadings, the authors explain that effluent quantifications are also probability distributions based on assumptions of pollutant concentrations or technology removal-efficiencies and non-point source pollution can be similarly quantified using ambient monitoring data and probabilistic land-use models. Through the use of monitoring and modeling techniques, uncertainty of non-point source loadings can be decreased and transaction costs can ultimately be reduced as result of more accurate ratios. The authors also note that advances in computational technology allow watershed models to be quickly adjusted for cite specific conditions.

There may be some validity to the authors' claim. However, the application of such monitoring and modeling techniques has been meager compared to the use of uncertainty ratios

as explained above because of the substantial start-up and operational costs necessary to undertake such initiatives. Furthermore, their argument is limited by the fact point source discharges entail far fewer variables of uncertainty that non-point sources despite the methods used to calculate their pollutant contributions.

Woodward (2001) provides additional insights for devising trading ratios with his divergence from the conventional economic cost-minimization models to an emphasis on environmental values. He maintains that cost-minimization approaches do not consider minimum standards for environmental assurances and are consequently incompatible with common regulatory frameworks. Although Woodward admits his model represents the opposite extreme, he concedes that a balance between least-cost and least-risk oriented ratios is necessary to achieve viable trading schemes.

Woodward et al. (2004) generalized the effects regulatory and market structures have on transaction costs. Market structures provide the actual mechanism for managing transactions and influence trading efficiency by the means in which they provide information to potential participants, facilitate participant interactions, and standardize units of trade. The overarching legal frameworks, which operate independently of individual trading markets, likewise affect the viability of a particular market structure. A break-down of legal frameworks by the authors reveals three important principles: authorization, monitoring, and enforcement. Authorization is the principle of implementing trading initiatives that comply with existing regulations and is a fundamental requirement for all trading schemes. The monitoring (and reporting) requirements may be part of existing regulations or an added component within a particular transaction. Such

requirements will inevitably increase transaction costs[7]. Finally, enforcement provisions determine the long-term, or post-transaction, costs related to continued compliance with applicable legal requirements. Another way of describing the enforcement variable is defining how sources are held liable for their actions. The authors describe a seller liability scenario, but buyer liability scenarios more accurately reflect current regulatory frameworks, which always require point source discharges to meet NPDES permit standards. Although this principle does not necessarily create additional transaction costs, the particular requirements for participant compliance can influence the attractiveness of WQT alternatives.

Empirical Literature

Though the majority of information offered in the theoretical literature addresses economic and environmental aspects of water quality trading programs (e.g., establishing effective yet economically beneficial ratios), the governance and administrative issues of implementing trading programs tend to be a large concern as well. Breetz et al. (2004) summarized the development and/or implementation of 40 watershed-specific programs, six statewide policies and programs, and 29 trading proposals in the United States. This report provides extensive information regarding the various aspects of each program, including specific obstacles to trading. The report is a useful resource for examining the numerous ways entities have approached the trading option; however, given the purpose and scope of this thesis, only portions of it are discussed here. Table 1 was constructed to demonstrate the major obstacles identified by Breetz et al. and to illustrate the considerations relevant to policy development and practice at the state level. The column titled "state policy or framework" most often refers to

[7] Stavins (1995) notes that administrative costs in conventional regulatory programs are analogous to transaction costs in trading programs. Thus, these and other similar costs (i.e., monitoring and reporting) may not be additional to previous requirements and warrant moderation in their application to calculations of total transaction costs.

Table 1. MAJOR OBSTACLES TO WATER QUALITY TRADING INITIATIVES
(Breetz et al., 2004)

WQT Scenario/ Cited Obstacle to Trading	State Policy or Framework	Watershed-Related Program
Insufficient Incentives for Supply or Demand (16x)	1	15
Legal, Trade Design, or Trading Concept Uncertainty (12x)	1	11
Insufficient Stakeholder or Political Consensus (11x)	3	8
Insufficient State or Local Funding (6x)	2	4
Uncertainty of Non-point Source Reductions (4x)	0	4
Participant Non-Compliance Issues (3x)	0	3

policy development and implementation obstacles where as those noted in the "watershed-related program" column are commonly associated with impediments to trading-market development or function. Multiple obstacles may have been noted for each trading initiative and seven watershed-related programs outlined in the report did not list any obstacles due to their lack of program development.

Most interesting are the number of times insufficient incentives for trading, information disparities, and political issues are cited. Although these results suggest additional considerations exist beyond market factors, there could be causal relationships between the fundamental theoretical and implementation issues. Given that the primary obstacle, presence of sufficient regulatory incentives, occurs independently at higher realms of policy and government, the focus of trading policy development should be directed toward the next prominent issues: political acceptability and stakeholder understanding.

As for the six state initiatives discussed by Breetz et al. (2004), four (Maryland, Virginia, West Virginia, and Wisconsin) were omitted from the analyses in this study due to their lack of statewide breadth, degree of progress, or overall inapplicability to Georgia policy development. For example, Maryland is revisiting policy development after a proposed framework in 1997 never resulted in finalized rules and legislation that authorized state funding for publicly-owned wastewater treatment facility (POTW) upgrades and agricultural BMP installment further removed economic incentives for trading. As of 2005, Virginia has trading rules which require POTWs within the Chesapeake Bay watershed to obtain offsets for new or increased discharges; however, the commonwealth did not develop "statewide" rules that govern trading markets used to achieve net reductions. During discussion periods, West Virginia could not reach a consensus among stakeholders and policy-makers on which provisions would be best for a state policy there. Lastly, Wisconsin passed rules in 1997 that authorized three watershed-based pilot projects, but abandoned these efforts by withdrawing state funding when the pilot projects failed to produce significant trades.

State Analyses

Water quality trading initiatives have been pursued for more than two decades and now occur in many states across the country. However, trading management at the statewide level is still in its infancy. Only six states have officially issued trading policies or frameworks of such scale to date and a seventh, Ohio, is pursuing an open process for developing rules. Perhaps the greatest cause of so few state-level initiatives is the paucity of successful watershed-level programs to inform policy development or even to warrant state involvement. Nevertheless, the emergence of new statewide initiatives indicates a proactive approach to WQT governance. Authorities are expanding the guidance, oversight, and management from isolated programs to broader, more standardized efforts.

The seven state programs identified range in nature from specific regulatory authority to guidance under conventional legal frameworks and from general state-agency oversight to absolute state-agency facilitation. Despite a small number, the examples present a diversity of alternatives for Georgia policy-makers to consider should they decide to develop a state trading framework in the future. Eleven policy aspects pervade throughout the examples and are therefore discussed in aggregate. Unique characteristics of each initiative are subsequently explained within a state-specific context.

Common Policy Components

Eleven general policy components were identified in the seven state models, many of which are discussed in the federal Water Quality Trading Policy. Slight variations do occur between each state, but the general concept of each is mentioned here for simplicity. Table 2,

included at the end of this chapter, displays the common components as well as other elements identified in each of the models.

Define Geographic Limits

All seven states require trades to be conducted between sources within the same watershed or similarly defined hydrologic unit. The purpose of this is to ensure that trading activities achieve water quality improvements within the water segment of concern. Determining the appropriate scale (e.g., trades between sources discharging to the same stream reach or sources within a larger common watershed) should be based upon whether water quality concerns occur at the immediate local or larger receiving-water level. Geographic limits may be defined within a TMDL, remedial action plan, watershed management plan, or other compulsory limitation.

Define Allowable Scenarios

Allowable scenarios define the regulatory contexts in which WQT may be utilized. Though each state policy or framework does not include all the following possible scenarios, the general concept is specifically stated in each. In fact, many of the states only allow trading within the last scenario: closed trading.

The first possible scenario includes WQT in unimpaired waters when compensatory trades are used to maintain the current water quality status. An example of this may include a point source generating offsets within the watershed to compensate for a new or increased discharge. As stated in the introductory chapter, the major driver for this type of trading is to prevent further imposition of a regulatory limit such as a TMDL. Key legal variables in this

scenario are individual state antidegradation laws and the protection of local water quality. Maximum allowed increases may be defined in individual discharge permits in order to prevent "hot-spots."

The second possible scenario involves trading prior to the development of a TMDL for an impaired water segment, or pre-TMDL trading. Where allowed, trades are specifically prohibited from delaying the development or implementation of a TMDL. If trades do occur before completion of an impending TMDL, states may work to incorporate these reductions into the load and waste load allocations. Even if pre-TMDL trades are included in the final allocation, additional reductions may be necessary when such efforts are insufficient to achieve full reduction goals. Finally, all seven states explicitly allow trading for the achievement of established TMDLs or other similar limitation (i.e., closed trading). The federal Clean Water Act grants broad authority to regulate WQT if provisions are properly incorporated into TMDL plans.

Describe Suitable Pollutants

Nutrients and sediment are the most commonly authorized pollutants for trade because they are not innately hazardous to human or ecosystem health and they are readily controllable through available technology and easily implemented land use management practices. In fact, the Connecticut and Pennsylvania programs limit activities to the trading of such substances. All other allowed pollutants states deem suitable for trade, such as temperature and bacteria, are specifically listed within each policy and are individually listed in the following state summaries.

Define Certain Trade Prohibitions

The most frequently noted prohibition is the use of trading to comply with technology-based effluent limitations, which is specifically prohibited in the federal policy. The second most common exclusion of trading is when individual trades result in a "hot-spot." State policies require trading to be utilized in a manner that protects or improves the quality of the water body where they occur. The third common prohibition refers to bioaccumulative toxics. Of the five states that allow trading of pollutants other than nutrients, three explicitly prohibit toxic pollutants due to the health risks posed. In contrast, Oregon specifically allows for these types of trades if they encourage reductions otherwise infeasible through conventional methods and when designed to protect water quality standards. The final most commonly identified prohibition is in regards to the violation of antidegradation and antibacksliding laws, which have already been discussed in previous sections of this thesis.

Specific Liability Provisions

Oversight and enforcement mechanisms utilized by each state generally originate from pre-existing state and federal laws. Participant liability is often defined in NPDES permit provisions, but additional requirements and the states ability to enforce them may stem from new legislation, specific rules, or trade-specific contracts. Additionally, states may enforce participant liability by: modifying permits; reviewing and enforcing discharge monitoring and reporting information; and continuing ambient water quality monitoring efforts. Where non-point source liability is suggested or required, third-party agreements and private contracts provide the means for enforceability.

Baseline Establishment Methods

Baselines are established through a number of ways, but are specifically discussed by each state except Connecticut. In open trading, states generally set current discharge limits defined in NPDES permits as baselines for point sources and existing land use and management practices as baselines for non-point sources. For closed trading, baselines are established by waste load and load allocations of TMDLs or similarly defined limitations. Where applicable, minimum requirements for other state and local programs further influence the establishment of baselines.

Define Credit Quantification Methods

Credits must be quantified in units that are measurable. The most common requirement from states is that credits be defined by a unit of pollutant per unit time such as pounds of phosphorous per week or concentration of bacteria per month. Appropriately quantified credits are relevant to meeting specifically defined water quality standards and enable regulators to more easily assess whether reductions are equivalent to the discharges they offset.

Address Uncertainty and/or Equivalency

Each of the state policy models called for the use of some type of ratio to adjust for trading uncertainty. Most common is the requirement of uncertainty or equivalence ratios for trades involving non-point sources. Although Connecticut's trading program only involves point sources, equivalence ratios are similarly required to adjust for relative contribution differences which result from a source's location within the watershed. Methods for developing ratios range from using sophisticated, predictive watershed models to policy decisions which account for

market and environmental consequences. The various approaches for addressing uncertainty are further described in each state summary.

Public Access, Notice, or Participation

Public access to information is an important part of credible trading programs. It is highly encouraged by federal trading policy and is seen in every state program. Public display of information, notices, and participation are all requirements of NPDES permitting programs and can be utilized when trading provisions are incorporated into new or modified discharge permits. Further mechanisms such as publicly accessible trading registries, agency websites, annual reports, and hearings are also utilized by states to inform the citizens of trading activities and to garner input on policy development. Public participation is a vital part of every programs success and is touted as a necessary means to maintain a credible reputation.

Monitoring and Reporting Requirements

Monitoring and reporting requirements of trading programs either coincide with or are analogous to those required by NPDES permit programs. The purpose of these activities is to document and clearly illustrate the actual reductions being achieved. Data provided by monitoring and reporting provide valuable information for keeping sources accountable for their agreed upon reductions as well as ensuring that regulated sources maintain compliance with permit standards. Furthermore, data can be used to asses the effectiveness of non-point source management practices and trading programs as a whole. All seven states require point sources to maintain discharge monitoring information as required by NPDES permits and various requirements are made of non-point sources.

Program Assessment Provisions

Assessments are essential to maintaining relevant and effective policies. Every state analyzed except Idaho has some prescribed mechanism for review and evaluation of its initiatives. Although Oregon has not defined a process for systematically reviewing the program, its Internal Management Directive noted that public display of trading information will facilitate some critique of such initiatives. The most common mechanism is an annual or multi-annual review of trade activities and their subsequent economic and environmental outcomes. Important information to evaluate includes: public comments, participant monitoring and reporting data, ambient water quality data (pre- and post-trading), and the amount of trades occurring as well as the administrative or other associated costs to the state.

Individual Summaries

Colorado

Background

Since the mid-1980s, local entities of several Colorado watersheds have pursued trading initiatives with guidance from the Water Quality Control Division (hereafter "Division" or CWQCD). Pollution impairments such as phosphorus have been addressed in the Bear Creek, Chatfield Reservoir, Cherry Creek, and Lake Dillon watersheds; multi-media pollutants in the Clear Creek watershed[8]; and ammonia, temperature, and pH in Boulder Creek (Environomics, 1999). A range of regulatory incentives at the federal, state, and local levels have compelled these initiatives; however, the number of trades has been nominal due to various issues (see

[8] Breetz et al. (2004) describe this program as "orphan trading" in which sources that need credits implement remediation or abatement efforts at abandoned locations in order to receive positive publicity. Environomics (1999) notes the Clear Creek initiative only produced one trade and was subsequently discontinued due to ambiguities of liability and other legal issues.

related obstacles in Table 1 and program-specific descriptions in Breetz et al.). Despite varied results and minimal trades, some programs have achieved notable cost-savings and Colorado continues to emphasize the potential benefits of water quality trading.

Drawing from its twenty years of experience, The Colorado Water Quality Control Division (CWQCD) released a statewide trading policy in 2004 in order to guide the future utilization of trading. The Colorado Pollutant Trading Policy (CWQCD, 2004), written in conjunctive effort with stakeholders across the state, provides a framework of environmental and legal considerations entities should address when developing a new trading scheme. Since Colorado does not have specific statutory or regulatory provisions for water quality trading, any CWQCD oversight powers are derived from Clean Water Act §303(d) and Colorado Water Quality Control Act (C.S. §25-8-101 et seq.) The Division uses existing NPDES permitting authority to manage trades point sources engage in with unregulated non-point sources (CWQD, 2004). As indicated in the policy, CWQCD anticipates the majority of future trades in Colorado will be in response to TMDLs or other defined limitation.

Specific Policy Features

Colorado's policy requires each trade proposal to be evaluated on a case-by-case basis by the Division in order to ensure proper adherence to applicable standards and requirements such as those described in the "Common Policy Components" section of this thesis. Of particular concern for trade approval is that of adherence to state antidegradation and antibacksliding provisions (C.C.R. §1002-31-31.8 and §1002-61.10, respectively). The policy describes three designations of waters pursuant to the state Antidegradation Rule, including: 1) "outstanding waters" that must always maintain existing quality; 2) "reviewable waters" that must maintain

current water quality unless determined appropriate for social or economic development pending an antidegradation review; and 3) "use-protected" waters, which is the minimum standard for all state waters and requires a level of quality necessary to protect designated uses. In regards to antibacksliding, the policy allows trades that result in permit modifications with lower effluent standards if an equivalent offset is purchased or if deemed permissible within TMDL provisions. If the majority of trades occur within the context of a TMDL, then trades will most likely be conducted to achieve tightened effluent standards and not necessarily to facilitate increased discharges.

The trading policy does not explicitly restrict the trade of any pollutant types, except bioaccumulative toxics. In fact, the policy even allows for unconventional units of trade such as those created by habitat offsets and flow augmentation when a participant can clearly demonstrate a quantified reduction or offset of the particular pollutant of concern. All trades involving non-point sources, cross-pollutants, or unconventional reduction methods must translate credits into equivalent units or use appropriate environmental indicators suitable for the type of reduction required. Examples of appropriate units include, but are not limited to, mass per unit time for nutrients or sediments and concentration per unit time for *E. coli*. Trading ratios are the suggested mechanism to adjust for any uncertainty within individual circumstances.

The policy recommends the following factors be considered in the development of ratios.

- Degree of technical and logistical uncertainty associated with the credit generating method.

- Whether the credits are calculated or measured. Generally, measured values will be more reliable than calculated values; uncertainty is greater when the calculation method is used.

- The fate and transport of the pollutant over the distance between the pollutant source, trade source and points of regulatory compliance within the watershed. The distance factor should take into account the fate and transport mechanisms for the specific pollutant.

- Temporal variability of the pollutant load and of the pollutant reduction method. Credit ratios may be adjusted to compensate for variabilities in loading or treatment that may occur daily, monthly, seasonally, or annually as appropriate.

- Any time lag between implementation of the technology or practice and full performance. (p. 10)

Additionally, the policy suggests that a supplementary reserve of credits be generated within each watershed to provide additional security should any fail to be properly executed.

Besides holding purchasing sources liable for compliance with all regulatory standards and requirements, the policy further defines responsibilities for point and non-point sources. Point sources should incorporate any effluent discharge adjustments into their permits and should clearly describe non-point source offsets and applicable monitoring data into standard discharge monitoring reports. Some trades involving non-point sources may not be required to conduct

monitoring activities. In such cases, evaluation of an agreed upon model will be used to ensure compliance. Offsets created by non-point sources should be certified by an independent party qualified to evaluate load reductions through visual inspections. To verify reduction compliance, sources may be required to grant CWQCD access to their property.

Point sources are subject to violation penalties pursuant to state and Clean Water Act provisions, but are allowed a three year "true-up" period when credits purchased from a non-point source fail to be effective. During the true-up period, sources must comply with applicable effluent limitations through credit purchase or other reductions. This is a costly scenario and creates an incentive for point sources to purchase credits from reliable sources.

Baselines for both point source and non-point source credit generation are set at the most protective standards or limits applicable. Unique aspect to Colorado is the lack of requirements for non-point sources to first meet a TMDL load allocation before they can produce sellable credits (D. Parachini, personal communication, April 21, 2006). Once applicable state or local land-use management standards are met, non-point source reductions are eligible for trading. All credits generated beyond baseline requirements, as well as those traded, must be registered with a publicly accessible trading registry; though, the entity responsible for maintaining such a registry is vaguely defined within the policy. For trading schemes that involve more than two point source offsets, the policy advises the development of watershed protection plan or incorporation of trade provisions into previously established Section 208 Plans[9].

The final unique component of Colorado's trading policy addresses property rights issues. The provision explicitly maintains that pollution credits are not property rights. Dick Parachini of CWQCD explains that the state intends to allow WQT as a tool for achieving water

[9] Section 208 of the federal Clean Water Act requires states to develop areawide management plans for the control of non-point source pollution. Such plans should include implementation schedules and Best Management Practices for "significant sources of concern" (Hecox, E., Date Unknown (c)).

quality goals, which benefits the public, and not as a prospecting mechanism for future growth (personal communication, April 21, 2006).

Connecticut

Background

On April 3, 2001, the USEPA approved the Long Island Sound TMDL jointly proposed by the New York State Department of Environmental Conservation and the Connecticut Department of Environmental Protection (CDEP) for the reduction of nitrogen loadings. Nitrogen is the limiting factor of harmful algal growth within marine systems and is, consequently, the leading cause of hypoxic conditions in the Sound (CDEP, 2003). The TMDL allows trading between sources within the Sound's catchment, which is estimated to save the state $200 million over the 15-year reduction period (Breetz et al., 2004). A corollary of these provisions is an effort by the State of Connecticut to include publicly-owned wastewater treatment facilities (POTWs) into a reduction plan that provides shared facility upgrade costs and flexible effluent trading alternatives. Public Act 01-180 (later codified into Connecticut General Statutes §§22a-521 through 527 of Chapter 446k) institutes an implementation framework for the entire reduction program.

Since Connecticut represents a single watershed unit, its trading model more closely resembles a watershed-specific program than a statewide policy. Even so, this example illustrates how Georgia could utilize state legislation to issue general permits and administer trading initiatives on a basin-wide scale.

Specific Policy Features

The Long Island Sound TMDL establishes a 58.5% nitrogen reduction goal for both New York and Connecticut (Environmental Trading Network, Date Unknown). Public Act 01-180 (hereafter "Act") establishes the mechanism for achieving Connecticut's part and financial alternatives from the Connecticut Clean Water Fund and water quality trading provide the means for source compliance. A general permit pursuant to the Act allocates incrementally decreasing effluent limitations to 79 POTWs and prompts the sources to either upgrade their facilities or purchase a corresponding amount of credits from the state. The Act requires CDEP to purchase all credits generated by facilities within each year. This provision allows sources to recover a portion of their upgrade costs and encourages them to make early reductions in light of future restrictions and funding uncertainties. Sources that choose to upgrade can utilize Clean Water Fund assistance, which offers a combination of grant (federal and state) and low interest loan portions (NCAB, 2004). If sufficient assistance is not available or sources choose not to upgrade within a given year, they may purchase credits from the state. The state acts as a clearinghouse, then, purchasing and selling credits (i.e., equivalent credits) equalized by a factor that compensates for a source's geographic location and relative impact to water quality in the Sound (NCAB. 2004). The equivalence factor for each of the 79 POTWs is defined within the general permit. Lastly, credits not purchased from the state are retired at the close of the year and contribute a water quality benefit (P. Stacey, personal communication, April 4, 2006).

The general permit not only establishes individual effluent limitations, but also defines the individual operating, monitoring, and reporting requirements. These elements are similar to the standards and procedures otherwise required of sources with individual permits issued under C.G.S. §22a-430 et seq. Additionally, the Act creates a Nitrogen Exchange Program, a Nitrogen

Credit Advisory Board, and the administrative roles of both the Board and CDEP. The Advisory Board is composed of political and appointed delegates who represent various stakeholder groups and geographic regions of the state. Section 3 of the Act describes the duties of the Board as "to assist and advise the Commissioner [of CDEP] in administering the nitrogen exchange program." Sub-section 3(c) and section 8, respectively require the Board to submit annual reports of credit exchange activities and facility upgrades. The Board must also determine the annual price of equivalent credits, which is calculated by dividing the total annual facility-upgrade costs by the amount of nitrogen reduced within that year (NCAB, 2004). Administrative duties of CDEP include, but are not limited to, establishing individual waste load allocations and equivalence factors for each source under the general permit, supervising source compliance with annual limitations, and managing the purchase and sale of equivalent nitrogen credits.

Clean Water Funds are annually appropriated from the state legislature and are used to finance facility-upgrade projects. A portion of the account is also earmarked for purchasing credits. This funding structure means the state contributes significantly to nitrogen reduction efforts; however, the additional cost of facilitating trade activities is quite low due to the straightforward framework (P. Stacey, personal communication, April 4, 2006). Principally, the added cost of administering the exchange program each year is equal to the number of equivalent credits purchased minus the number of equivalent credits sold. Annual Advisory Board reports indicate that credit purchases cost the state $1-1.4 million and $311,761 in 2002 and 2003, respectively (NCAB, 2002; NCAB, 2004). Both reports note the removal efficiency of facilities and the successive demand for credits are highly influenced by the amount of annual precipitation. Accordingly, low precipitation and high removal efficiency led to surplus credits

and high implementation costs in 2002 *versus* high precipitation and low removal efficiency resulting in greater credit demand and lower state costs in 2003. Most vital to the adequacy of the reduction program, however, is the availability of annual Clean Water Funds (NCAB, 2004). These funds are necessary to finance facility upgrades and influence whether POTWs will produce or demand credits. Consequently, the success of the nitrogen reduction and credit exchange programs are, to some extent, more dependent upon annual state funding than on typical market forces.

While Connecticut has instituted additional legislation to regulate water quality trading, it did not, to any large degree, have to institute further duties, restrictions, or guidance for point sources beyond those already present within its Water Pollution Control Act. Specific provisions regarding antidegradation and antibacksliding were also not necessary because trading under the general permit framework does not involve increases of effluence. Although fluctuations in actual discharge may occur year to year, USEPA approved the program given that facility upgrades and credit trading ultimately result in net discharge reductions and help attain goals of the Long Island Sound TMDL more quickly than conventional methods (P. Stacey, personal communication, April 4, 2006).

Idaho

Background

Idaho is exploring water quality trading specifically as a means to carry out court-ordered TMDL reduction schedules (Breetz et al., 2004). To date, trades have been proposed for exchanges between point and non-point sources in the Lower Boise River and between point sources in the Middle Snake River (IDEQ, Date Unknown). In 2003, the Idaho Department of

Environmental Quality (IDEQ) released a draft guidance document to inform potential TMDL stakeholders of the requisite considerations and processes associated with trading alternatives. Idaho Administrative Code §58.01.02.054.06 officially authorizes the use of pollutant trading for achieving TMDLs or equivalent processes, but does not provide additional authority or guidance. The Department of Environmental Quality's ability to control trading is restricted, however, because it does not administer a state discharge permit program. Nevertheless, IDEQ is able to institute minimum standards and procedures in the TMDL development process.

Water quality trading within the context of permit modifications and TMDLs implementation does not pose significant costs for Idaho because the state does not administer its own NPDES program. Evaluating trade proposals will largely be the responsibility of USEPA and initially the state will only be responsible for maintaining trading information on the IDEQ website (S. Burke, personal communication, April 4, 2006).

Specific Policy Features

The methods employed to develop TMDLs in Idaho provide unique opportunities to develop specific trading parameters on a river basin or comparable scale. Total Maximum Daily Loads are developed in collaboration with watershed and basin advisory groups, which communicate stakeholder interests to IDEQ, and must receive final approval from USEPA. Point source effluent limitations defined in TMDLs are enforceable through federal NPDES permit provisions, but load allocations for non-point sources can only be regulated through C.W.A. §319(h)[10] funding and state or local cost-share programs. As for baselines, a TMDL load allocation must first be met before non-point sources can begin to generate sellable credits

[10] Amendments to the federal Clean Water Act in 1987 included a new federal grant program under §319. The program provides funding to states that develop and implement non-point source BMP programs (Hecox, E., Date Unknown (c)).

(S. Burke, personal communication, April 20, 2006). However, this requirement is not restrictive to agricultural sources, which are exempt from implementing BMPs otherwise required by non-point sources under a TMDL (Hecox, E., Date Unknown (d)).

Trading within the context of TMDL compliance implies that point sources are the principal buyers of pollution credits. The guidance policy states that point sources may enter into private trading contracts with either point or non-point sources that generate reductions in the same month for which credits are purchased. Because point sources are constantly responsible for meeting their permitted effluent limitation pursuant to the federal Clean Water Act, a credit-purchasing source is likewise liable for ensuring agreed upon reductions are properly executed. The policy notes that in order to protect local water quality, sources may have an upper effluent limit established within their NPDES permit. This may restrict the number of credits a source can purchase to meet its effluent limitation. However, diminution of local water quality is not likely to be an issue under the described circumstances unless a point source is in violation of its discharge limitation.

All credits provided by non-point sources must be measured or calculated and are determined by multiplying the BMP load reduction by the applicable adjustment ratio and subtracting a water quality contribution. Measured credits involve the use of BMPs that can be directly monitored to assess their reduction contribution. Calculated credits involve the use of BMPs that have been previously evaluated, but are difficult to directly monitor. Although calculated credits are not directly monitored, minimum inspection requirements are still necessary to ensure proper installation. Furthermore, calculated credits must incorporate an additional discount factor to adjust for any uncertainties. Adjustment ratios are calculated based on a source's relative contribution to water quality and are determined on an individual basis.

Each trade activity proposed within the context of a permit must be reviewed in order to verify the adequacy of a local impact assessment as well as the application of appropriate ratios and discount factors. Non-point sources may choose to generate credits by means of pre-approved BMPs (included in the guidance policy appendices) or with newly proposed BMPs. Any new BMPs must be approved through a process outlined in section V(A) of the guidance policy.

Idaho allows participants to keep trade details such as credit prices private, but requires documentation of compliance to be publicly accessible. Point sources must complete and submit the following documents to the Idaho Clean Water Cooperative for entry into a public trading database.

- **Trade Notification Form.** This form is requisite for each trade and is the official registration of credit transfers and applicable adjustments to effluent limitations.
- **Reduction Credit Certificate.** This document is requisite for each trade involving non-point source reductions and certifies that the purchasing source has verified proper installation of all BMPs.

The Idaho Clean Water Cooperation is a tax exempt cooperation established under section 501(c)(3) of the federal Internal Revenue Code of 1986 (26 U.S.C. §501(c)(3)) to assist the State of Idaho in administering day to day trading duties (ICWC, 2000). Once trades actually commence, the Cooperative will maintain a publicly accessible trading registry and prepare Trade Summary Reports for point sources. Trade Summary Reports are based upon information from the Trade Notification Form and Reduction Credit Certificates. Once completed and

returned to the point source, Trade Summary Reports and standard Discharge Monitoring Reports must be submitted to the USEPA for review.

The role of the state is to investigate any discrepancies in compliance reporting. Idaho law limits regulatory authority to evaluating violations through water quality monitoring (Hecox, E., Date Unknown (d)); thus, additional enforcement assistance from USEPA may be necessary at times. The Soil Conservation Commission will take part in reviews of non-point reductions that are "funded in part or in full by state-administered cost-share programs" (IDEQ, 2003, p. 9).

The final unique characteristic of Idaho's pollutant trading guidance is the requirement of agricultural sources to develop farm-scale or watershed-scale plans when generating marketable permits. Plans should include an outline of water quality problems associated with the property and the implementation strategy for creating reductions. The type of plan necessary is based upon whether credit will be generated on a farm or watershed level. Both plan types require consultation and certification from a qualified individual such as a National Resource Conservation Service or Soil Conservation Commission technician.

Examples of a Reduction Credit Certificate, Trade Notification Form, approved BMPs and trading ratios are included within the appendices of the policy document for further reference. More specifically, Appendix B describes the lifespan and uncertainty factors of approved BMPs and trade ratios for sources in the Lower Boise River Watershed.

Michigan

Background

Michigan adopted trading rules (M.A.C. §323.3001-.3027) in November 2002 following the completion of a market-based feasibility analysis in 1997 and a demonstration project

(Kalamazoo River) in 2000. These legally enforceable rules provide the Department of Environmental Quality (MDEQ) a direct mechanism for addressing unregulated non-point source pollution (Breetz et al., 2004) as well as specific legal guidance for potential participants. The greatest distinction of Michigan's framework is the gap it bridges between newly created authority and authority exercised through pre-existing legal frameworks. The trading rules were created pursuant to state water quality laws, Part 31 of Michigan Act 451 of 1994 (M.C.L. §324.3103 et seq.), and require coherence to pre-existing state and federal standards (MDEQ, 2002b). The legal framework for regulating trades in Michigan is unique compared to other states; though, the content of its rules are quite similar. Most rule sections entail some variation of the common components found in many state policies and frameworks.

Michigan intended for the specificity of the rules to be a useful tool for administering trades throughout the state; however, that exact specificity has led to a stifled, if not inexistent, use of WQT in the state. The difficulty of implementing complex rules and the loss of adequate state funding have led to severe consequences for the program. MDEQ is unable to address proposed modifications to trading ratios in the Kalamazoo River watershed due to a lack of resources. Although an Indian tribe in the Kalamazoo watershed has secured federal funding for the development of a trading registry, no further trading activities have commenced in Michigan (R. Hobrla, personal communication, April 3, 2006). Despite the lack of trades to date, some details of the rules as well as the unique policy elements warrant further mention.

Specific Policy Features

The general concepts outlined in detail include: 1) new roles for the MDEQ; 2) restrictions on trading eligibility; 3) baseline establishments for various source types; 4) methods

to compensate for uncertainty and equivalency; 5) credit life and use; 6) trade notification and review processes; and 7) compliance and enforcement measures. Elements entirely unique to a state-level policy include the right to trade nutrients by rule and provisions for credit banking.

The establishment of rules has created new responsibilities for the state. A Department of Environmental Quality website lists the following duties created for MDEQ under the trading rules.

- Developing notice of generation and use forms and reporting forms for point and non-point sources.

- Reviewing and issuing completeness determinations for notices of proposed trades within 30 days.
- Creation and maintenance of a trading registry that is updated daily.

- Conducting comprehensive trading program evaluations, a statewide evaluation 3 years after the rules take effect, and watershed specific evaluations every 5 years in conjunction with permitting and ambient monitoring cycles.

- Reviewing and approving watershed management plans for the purposes of trading.

- Providing Internet access to the trading registry.

- Conducting administrative reviews of citizen petitions.

- Technical evaluations, including alternate quantification protocols, site-specific discount factors and case-by-case reviews for other types of trades.

- Delineating Michigan's Major Watersheds. (MDEQ, 2002b)

These new duties have associated costs as well. Michigan spent approximately $208,700 in the first three years for three program personnel (Breetz et al., 2004). Since trade participants are given the responsibility of demonstrating their compliance with effluent standards or their fulfillment of agreed upon reductions, additional oversight costs are minimized for the state.

The rules define particular exclusions for eligible trading participants and the pollutants they may exchange. Of the many listed eligibility requirements, the most noteworthy are exclusions of point sources that are not currently in compliance with monitoring, recordkeeping, or reporting requirements of their discharge permits and non-point sources that generate reductions with funds from Michigan Brownfield Redevelopment Grants (Public Act 288, M.C.L. 324.19601 et seq.) or Clean Water Act §319(h) Grants. R. Hobrla of MDEQ noted that these restrictions were placed on non-point source participants due to concerns of providing public funds to citizens who would receive double compensation for the reductions they generated (personal communication, April 3, 2006). Trades to meet technology-based effluent limitation or involving specific bioaccumulative toxics are also prohibited. Despite these particular restrictions, Rule §§323.3006 through 3009 describe a multitude of other eligible participants and methods for generating and using credits, including pretreatment trading.

Methods for establishing baselines are specifically described for the various pollution sectors. The following are brief descriptions of how baselines are determined for each sector.

- **Non-stormwater point sources.** The most protective discharge permit limitation, waste load allocation, or other water quality-based effluent standard applicable are used as baselines and must be expressed in pounds of pollution per day.

- **Federally regulated stormwater sources.** Credits are generated when reductions are made beyond the implementation of required management practices. Separate conversion equations are used to calculate baselines for sources with differing delivery methods (i.e., direct discharge or diffuse loading). Sources must monitor abatement practices to evaluate the actual loading reduction.

- **Unpermitted stormwater sources.** Stormwater sources not subject to federal permitting requirements may still be subject to a TMDL or other similar allocation. Where TMDLs exist, the load allocation or prescribed management practices set the baseline. The existing land-use management practices set the baseline for sources not subject to a TMDL. In the latter case, baselines are calculated using loading factors for specific to various land use categories.

- **Agricultural non-point sources.** Agricultural baselines are determined in much the same fashion as unpermitted storm water sources. However, baselines for unregulated sources are calculated with loading models appropriate for the circumstances. Agricultural baselines, load reductions, and credits must be quantified in pounds of pollutant per year or month.

- **Streambank erosion non-point sources.** Baselines for streambank erosion reductions are determined by either the existing loading level if no management practices are required or the loading levels after implementation of management practices required by applicable watershed management, remedial action, or lakewide management plans. Baseline and reduction quantities must also be expressed in pounds of pollutant per year or month.

When developing the trading ratios in Michigan rules, the best available scientific information was used (R. Hobrla, personal communication, April 3, 2006). These ratios (defined in Rule §§323.3016 - .3017) require all trades to achieve a net water quality benefit using 1-time contribution percentages. Point source reductions must contribute a 10% contribution for every credit they generate and non-point sources must apply a 50% contribution. Additional discount factors may be applied to address geographical variables that increase uncertainty. For example, a wastewater treatment facility that produces ten surplus credits must contribute one for the net water quality benefit and employ a discount factor should it engage in trading where a dam is between it and the purchasing source.

Michigan's rules directly address the use of credit banking, which no other state policy does. Reduction credits are to be generated contemporaneously or prior to their period of use. However, *nutrient* credits (total phosphorus and total nitrogen) can be banked for up to five years after their generation. As an incentive to achieve early reductions, nutrient sources may bank credits that are produced to comply with TMDL standards, but are produced prior to a compliance deadline.

Open and closed nutrient trading may occur by rule (Rule 7 and 8, respectively) if basic water quality protection conditions are satisfied. In open trading, point sources may only increase their discharge by 20% above their defined effluent limit unless otherwise specified. Provisions for such an increase must be approved and incorporated into discharge permits prior to utilization. Trades other than standard nutrients exchanges, including nutrient credit banking, must first receive approval from MDEQ. All credits must be verified for completeness by MDEQ when they are generated and before they can be sold (MDEQ, 2002a). Once credits have been verified, the Department is responsible for promptly entering the associated information into a publicly accessible registry. Furthermore, the agreed upon procedures and practices outlined in a credit notification become legally binding once MDEQ has issued a determination of completeness.

The enforcement provisions of Michigan's rules are perhaps the strongest and most far reaching. A dual-liability system is established whereby point and non-point sources are held accountable for agreed upon reductions. Sources that generate or use credits are subject to treble damages defined under Revised Judicature Act of 1961 (M.C.L §600.631) and permitted sources are subject to penalties defined within their discharge permits should they not meet applicable limitations. Like Colorado, Michigan offers a true-up period for sources that are out of compliance with trade agreements. The severity of penalties and the allowed true-up time varies depending on whether MDEQ identifies the violation or whether the source brings it to the attention of the Department first. Citizens may petition MDEQ to enjoin a particular action if they can demonstrate the activity is not complying with trade agreements or is causing a water quality impairment.

The final unique element of Michigan's rules is the requirement to delineate the watershed trading activities will take place. Although the applicability of such delineations is not further explained, Rule 22 requires the use of previous watershed delineations by MDEQ for open trading. For closed trading the use of defined boundaries in TMDLs, watershed management plans, or other appropriate delineations. Accordingly, Rule 23 requires participants to submit applicable information for MDEQ review prior to the use of trading for the achievement of TMDLs or other watershed management plans.

Ohio

Background

Nutrient loading from agricultural non-point sources is a major cause of impairment for water bodies in Ohio. Water quality trading is already being explored to achieve nutrient reductions in the Upper Little Miami River and the East Fork of the Little Miami River (Breetz et al., 2004). Currently, the Ohio Environmental Protection Agency (OEPA) will incorporate provisions for these trades in NPDES permits on an individual basis using general permitting powers vested in it by existing legislation. Despite a lack of executed trades in Ohio, OEPA released a framework for developing specific trading rules in November 2005 based on growing interests in the alternative. The agency asserts that trading rules will reduce concept uncertainty, which is a frequently cited obstacle to trading initiatives (OEPAa, 2005). The following points are potential areas of uncertainty and subsequent justification for rules listed within the framework document.

- *It's an unfamiliar option for complying with an NPDES permit*. Rules would clarify what is involved in trading by including specific requirements and by providing the necessary legal foundation for the program.

- *Point source liability for meeting limits upon failure of nonpoint source projects*. Rules would include a specific procedure for addressing nonpoint source default. *The impact of early load reductions in pre-TMDL waters* Rules will address how early reductions will be treated in setting TMDL baselines and establishing credits.

- *Quantifying load reductions for nonpoint source project*. Rules will establish standardized protocols to quantify pollutant loads, load reductions, and credits.

- *Confusion over trading ratios*. Rules will establish trading ratios and the conditions that would warrant adjustments to the ratios.

- *Public perception of trading program*. Rules will show the state's support for water quality trading and provide an opportunity for public participation in developing rules. (p. 2)

Besides encouraging sources to extensively consider all the particulars water quality trading entails, the decision for rule development stems from a demand from the Ohio legislature to establish such when agencies intend to implement extensive statewide programs (G. Stuhlfauth, personal communication, April 3, 2006). This direction has not come without

adversity, however. Dusty Hall, a spokesman for the Miami Conservation District (MCD)[11] programs, and Gary Stuhlfauth of OEPA described in separate interviews several points of contention between current sub-state trading initiatives and proposed OEPA rule provisions. Details of these issues are included in the next "Specific Policy Features" section.

The policy components outlined in Ohio's framework mirror those recommended in the federal WQT policy as well as those found in other state frameworks. However, as rule-making continues to develop, greater specificity will be included than presented in the initial document. It is critical to note that the framework described here is a proposal for developing rules and does not serve as an active policy; rather, it defines the guiding principles for which more detailed rules will be built upon. Once adopted, trading rules will be implemented under statutory authorities afforded by the federal Clean Water Act and NPDES permit and TMDL provisions of state Water Pollution Control Laws (O.R.C. Ch. 6111). Even though Ohio is taking a similar approach, it intends to avoid the pitfalls seen in Michigan by not drafting rules that are too specific and potentially stifling (G. Stuhlfauth, personal communication, April 3, 2006).

Specific Policy Features

The most unique offering of the Ohio model is an illustration of how trading policy development can proceed and what underlying issues may need to be addressed. Several critical issues, which are marked by differences between proposed state and existing sub-state policies, remain to be solved through the rule development and review processes. Most notably, MCD officials contend that rule development at the state level is premature due to a lack of actual

[11] The Miami Conservation District is a multilateral regulatory agency and is responsible for overseeing trades within the Miami River Valley (G. Stuhlfauth, personal communication, April 3, 2006).

trades to inform the process. There are concerns that rules may create unwanted restrictions and discourage participation to otherwise voluntary—and still forming—programs.

Another contentious issue involves baselines for non-point sources located in TMDL-established watersheds. Currently, MCD requires non-point reductions funded by Conservation Security Program (CSP)[12] or §319(h) monies to first be applied toward the non-point load allocation of a TMDL. Only after the load allocation has been met can publicly funded practices on private lands be used to generate sellable credits. Of greatest concern here are the concepts of "additionality" (i.e., reductions made beyond required baseline conditions) and the optimal use of public funds. If funded practices are immediately sold to offset point source requirements, then no reductions are being achieved toward the load allocation as required by the federal trading policy and, certainly, the goals of both federal funding programs would be thwarted. Accordingly, public funds would not realize the maximum water quality benefit per dollar spent (D. Hall, personal communication, April 6, 2006). Nevertheless, some discussion of allowing publicly funded practices to immediately generate credits has occurred at the state level. Gary Stuhlfauth (personal communication, April 3, 2006) clarified that the issue of allowing or prohibiting credit generation with publicly funded reductions is not a legal issue, but a policy one that will be dealt with in the public participation phase of rule development.

Finally, Hall noted two potential hindrances to trading from the agricultural community. One issue concerns access to private property. Landowners disapprove of requirements to allow state officials onto their land in order to verify BMP installment and function (D. Hall, personal communication, April 6, 2006). Secondly is the issue of fairness to agricultural producers who

[12] The Conservation Security Program is a financial and technical assistance program for implementing, among other things, soil and water conservation BMPs on private agricultural lands. The funds for this program are authorized under the 2002 Farm Bill (16 U.S.C. § 3801 et seq.) and are administered by the United States Department of Agriculture's Natural Resource Conservation Service (USDA, 2006b).

have practiced good land stewardship prior to trading initiatives and who may be ineligible to use historical reductions for credits. Hall (personal communication, April 19, 2006) maintained that mechanisms such as the Conservation Reserve and Security Programs are more appropriate compensating land owners with good stewardship histories.

To create an open dialogue of how trading policies will be structured to address the aforementioned and other potential issues in the state, a schedule for public review and comment has been set. The process advertised on OEPA's trading website (OEPA, 2005b) calls for a public circulation and review of the framework, followed by a distribution and review of draft trading rules to interested parties. Modifications to the proposed rules will then be submitted to the Joint Committee on Agency Rule Review (JCARR) for verification of appropriateness. Determinations of appropriateness are generally granted if proposed rules are consistent with statutory authority and intent and they do not conflict with provisions or powers of other agencies and rule-making bodies (OJCARR, 2006). Despite these general thresholds, Hall (personal communication, April, 6, 2006) clarified that state rules would override current MCD requirements. Following JCARR approval, final rules will be adopted.

Although the framework proposal is broad in nature, it does include a few unique policy elements. Ohio intends to use a 2:1 ratio between point and non-point sources trading in pre-TMDL waters and a 3:1 ratio for similar trades in TMDL-established waters. The Ohio Environmental Protection Agency hopes a 2:1 ratio will encourage early load reductions. The three credits of the latter ratio will be applied toward 1) the required point source reduction, 2) the amount of non-point source reduction, and 3) a level of uncertainty. These ratios have been included in the initial framework document in order to spur discussion on appropriate ratios in the state (G. Stuhlfauth, personal communication, April 3, 2006). There still lies a question in

Ohio of whether highly specific ratios, like those found in Michigan's rules, or easy to implement formulas, like those just listed, are most appropriate.

Another distinctive aspect of the framework is the assertion that participation from soil and water conservation personnel is vital to programs that wish to incorporate non-point source reductions. This concept is briefly mentioned in Colorado's enforcement section and is required for non-point source trades in Idaho that utilize cost-share funds, but is not intended for as large a scale as in Ohio. The framework lists the following important functions of soil and water conservation personnel.

- *Communication* People such as county SWCD staff are generally known by agricultural producers and have practical experience and knowledge of issues and concerns that are important to farmers.

- *Appropriate BMP Selection* Soil and water conservation professionals are able to determine which BMPs are best suited to achieve pollutant reductions at specific sites.

- *Quantifying Load Reductions* People with the technical knowledge and expertise can obtain the necessary data and use appropriate tools to calculate the estimated loading reductions for BMPs.

- *BMP Inspection* Qualified professionals can verify the correct installation of a BMP, conduct periodic inspections to ensure the BMP is functioning properly, and determine when a BMP has failed and is no longer eligible to generate credits.

- *BMP Monitoring* Qualified professionals can conduct required water quality monitoring to obtain data to verify BMP effectiveness and to evaluate and improve the spreadsheet used to estimate BMP load reductions. (p. 11)

No formal integration of state programs has occurred on a broad scale to date, but a Memorandum of Understanding has been reached between county soil and water conservation services and regulatory entities in the Upper Miami River trading program (G. Stuhlfauth, personal communication, April 3, 2006). This provides a rough model for how the related agendas of various state agencies can be coupled to achieve common goals.

Oregon

Background

Oregon water pollution control statutes (O.R.S. Ch. 468B) create unique and effective circumstances for implementing water quality trading. In 2001, the Willamette Watershed Improvement Act (O.R.S. §468B.550 - .555) established a state-administered trading program with special emphasis on the Willamette River. The Act called for development of procedures to guide participants through trading processes, the authority to oversee trade agreements, and for the Oregon Department of Environmental Quality (ODEQ) to seek no less than $200,000 in federal funding for the program. The result of the effort was the issuance of a single NPDES permit which covered multiple facilities belonging to one wastewater and sewerage entity. The permitted source was allowed to trade ammonia, BOD, and temperature waste loads between its various sources in the Tualatin River sub-basin (located within the Willamette River Basin). Drawing from the Tualatin River trading experience and the soon after release of USEPA's

federal trading policy, ODEQ developed its own trading framework to provide consistent oversight and guidance for future WQT efforts (ODEQ, 2005b).

The trading framework in Oregon's Water Quality Trading Internal Management Directive, or IMD (ODEQ, 2005a), outlines a process in which ODEQ will approve trade proposals on a case-by-case basis. The IMD resembles a guidance policy to a large degree; however, ODEQ is quick to note that it is not. S. Biorn-Hansen (personal communication, April 3, 2006) clarifies that ODEQ is obligated to develop rules for guidance issues and the Department does not wish to implement rules that may cause undesired effects on trading initiatives in the state.

Due to language in O.R.S. §468B.025, which prohibits any "person" from polluting any state waters, ODEQ has the authority to regulate point and non-point sources of pollution. Thus, in addition to common authorities granted by the federal Clean Water Act and state NPDES permitting and TMDL development statutes (O.R.S. §§468B.050 and .110, respectively), ODEQ has set minimum standards for agricultural and forestry practices. Standards set by the Agricultural Water Quality Act (O.R.S. §568.900 et seq.) and the Forest Practices Act (O.R.S. §527.610 et seq.) do not involve permits, but do require implementation of minimum management practices. These standards should play an integral role in the establishment of baselines for non-point sources in unimpaired or pre-TMDL waters; however, their unenforceability has rendered them obsolete (S. Biorn-Hansen, personal communication, April 3, 2006) and they are not even noted in the IMD.

The IMD does include several provisions that address trading issues specific to Oregon water quality problems. The following section discusses these Oregon-specific considerations as well as other policy elements unique to the state framework.

Specific Policy Features

Like most other states, trading in Oregon will be utilized to protect water quality standards or to achieve mandated reductions. However, the IMD explicitly states that trade provisions will be incorporated into NPDES permits, TMDLs, or watershed plans. Performance bonds, memoranda of agreement, and third party contracts are suggested mechanisms to enforce agreed upon reductions by non-point sources. Pursuant to the Oregon antidegradation policy, antidegradation reviews are required for all NPDES issuances and modifications; however, the IMD suggests that full reviews should not be warranted by trades that adhere to the IMD framework since they would result in a net water quality improvement. Section VI offers the following as acceptable approaches for incorporating trades into permits:

- General conditions in a permit that authorize trading and describe appropriate conditions and restrictions for trading to occur;

- The use of alternate permit limits or conditions that establish restrictions on the amount of a point source's pollution reduction obligation that may be achieved by the use of credits if trading occurs; and

- Authorization of trading within the permit, contingent upon the submittal of an acceptable plan by the permitted source to pursue trading. The plan will be subject to public review and comment, and when it is finalized, it will be incorporated into the permit as a permit modification. (p. 15)

The most unique policy elements address the types of pollutants eligible to be traded. Special considerations are made for temperature trading[13] and the policy allows for unconventional trades such as dam relicensing and offsets of bioaccumalative toxics. Where credits for most pollutants are generally required to be produced before or contemporaneously with use, temperature credits created by shade have been afforded an exception due to the time required to generate beneficial effects with vegetative cover. The ODEQ justifies this policy by insisting temperature offsets from tree planting will provide more comprehensive ecological benefits than end-of-pipe reductions from an individual source. Long-term maintenance plans must be approved before tree planting can generate sellable credits. However, some debate exists as to the adequacy of this process and the methods for establishing fair credits at different offset locations (S. Biorn-Hansen, personal communication, April 3, 2006).

In contrast to other states, ODEQ does not automatically prohibit trading of bioaccumalative toxics when trades help achieve reductions otherwise infeasible through conventional regulations. As with any trades, sufficient evidence must be provided to show trades will not cause a violation of a water quality standard nor cause undue health risks. The IMD does not, however, encourage the trade of bacterial concentrations due to the inevitable human health risks. Should a facility that produces credits close, the policy declares that these credits will "dissolve", or no longer be available for use.

A final uncommon element is the provision for surrogate monitoring. Beyond conventional trading ratios and margins of safety, surrogate monitoring is an additional mechanism to address uncertainty where direct monitoring of the pollutant may be insufficient. The example provided in the IMD relates to temperature which is inherently variable due to

[13] More than 80% of the 303(d) listed waters in Oregon are impaired by temperature. Consequently, ODEQ expects the majority of trades in the state to involve this pollutant (ODEQ, 2005a).

naturally fluctuating environmental conditions. Thus, to quantify actual offsets related parameters such as plant survivorship and shade density can be monitored. Additional requirements may be necessary to verify the accuracy of surrogate monitoring.

Pennsylvania

Background

The use of trading has been discussed for several years in Pennsylvania as a means to improve water quality within the greater Chesapeake Bay Region. Watershed-based trading administered by the state was recommended in 1997 by the 21st Century Environment Commission. Subsequently, the General Assembly passed House Resolution 361 in 2000 to commence further investigations of trading alternatives in the state (Pennsylvania Joint Committee, 2001). The resolution directed the Joint Legislative Air and Water Pollution and Conservation Committee (hereafter "Committee") to: 1) review policies and regulations of the federal and other state governments; 2) review trading programs of other states and the effectiveness of current Pennsylvania programs; 3) conduct public hearings on the issue; and 4) make final recommendations to the legislature. Among the items discussed in their subsequent report, the Committee recommended further development of trading alternatives through a WQT pilot program (Pennsylvania Joint Committee, 2001). As a result, the Conestoga River Nutrient Trading Pilot was launched in 2001 and was scheduled for completion in 2005. This program and a draft discussion paper (PDEP, 2003) of trading concepts released by the Pennsylvania Department of Environmental Protection informed the development of Pennsylvania's final trading policy (Breetz et al., 2004). The Nutrient and Sediment Reduction Credit Trading Interim Final Policy and Guidance (PDEP, 2005) provides interested parties an informational

resource for how the Pennsylvania trading program will operate. Currently, the program is focused on Chesapeake Bay 2010 nutrient and sediment reduction goals, but may be expanded to a statewide scope in the future (A. Smith, personal communication, April 5, 2006). As a further guidance on how trading works, details of each trading initiative conducted within the state will be added to the appendices. Pennsylvania is also in the process of developing a statewide multimedia trading registry to compliment ongoing WQT efforts. The pending registry, which may be administered by an external entity (A. Smith, personal communication, April 5, 2006), will act as a forum for trading information and may even serve a credit banking function (Breetz et al., 2004).

The policy and guidance document generally outlines many of the common policy elements described in previous sections of this thesis and is similarly implemented with respect to federal Clean Water Act and state law (Clean Streams Law, U.P.S. §691 et seq.) requirements. The following section discusses the unique elements included in Pennsylvania's policy to address the Chesapeake Bay Nutrient Reduction effort and other specific issues in the state.

Specific Policy Features

Nutrients from the landscape and point sources constitute the majority of water quality problems in the Chesapeake Bay ("Bay pollutants", 2003). Compounding the problem is non-point source sediment loads, which create adverse ecological impacts and carry even more nutrients into water bodies ("Sources of sediment", 2005). Consequently, Pennsylvania's trading policies are directed toward implementing voluntary nutrient and sediment reductions from both source types. All agricultural non-point sources wishing to generate credits are subject to minimum requirements, including the use of nutrient management budgets and buffer zones for

activities adjacent to water bodies. Three highly suggested practices for non-point reductions include forest riparian buffers, cover crops, and advanced nutrient management. The interim policy explicitly allows federal and state cost-share funds to be applied toward sellable credits if not otherwise restricted by the lending source, but may only do so after TMDL load allocations have been achieved (A. Smith, personal communication, April 17, 2006).

In order to achieve equal reduction amounts between point and non-point sources, Pennsylvania will consider use of the following types of trading ratios.

- **Uncertainty ratios.** These ratios provide a margin of safety when implementing reduction practices that may entail unexpected variations in reliability and efficiency. Additional use of this ratio may not be necessary when uncertainty is previously incorporated into reduction models such as the Chesapeake Bay Watershed Model[14].

- **Delivery ratios.** These ratios adjust for the natural reduction of pollution as it moves through the watershed. Natural reductions can occur as a result of nutrient uptake, biodegradation, and other natural processes. Thus, delivery ratios are calculated based on a source's location within the watershed and the relative effectiveness a reduction will have on water quality.

- **Retirement ratios.** A portion of each reduction credit may have to be retired to ensure net water quality benefits. Retirement ratios are the portion of the reduction not available for sale.

[14] This model is an essential tool for predicting pollutant loadings under variable source reduction and watershed development scenarios. The model calculates necessary reductions from sources within the watershed in order to meet water quality goals ("What are environmental models", 2002).

- **Special needs ratios.** These ratios may be necessary to address specific water quality concerns not covered by other trading ratios.

Although the program is still very new, Pennsylvania has already realized benefits from the policy development process such as productive discussions of management strategies between multiple stakeholder groups in the Chesapeake Bay region (A. Smith, personal communication, April 5, 2006). Nevertheless, the interim policy is still open to modification. The Department is currently reviewing stakeholder and public comments in order to determine needed changes to the program. Initial comments indicate that more specificity and detailed illustrations of potential trading schemes are needed in the next version, which is due mid-2006 (A. Smith, personal communication, April 17, 2006).

Summary of State Models

A range of policy approaches to state-managed trading are presented by these seven models. In general, each state employs an approach that requires trade alternatives to supplement current regulatory methods and that must comply with standards of the federal Clean Water Act and state water quality laws. The seven states can be sub-divided into two general categories: those that develop broad policies to manage trading within pre-existing legal frameworks (i.e., general authority) and those that have created specific rules, regulations, and/or legislation. States in the first category include Colorado, Idaho, Oregon, and Pennsylvania and state in the latter category include Connecticut, Michigan, and Ohio (once rules are finalized). The language specificity in each state's official trading documents varies considerably as well. Michigan and Connecticut have very detailed programs that provide participants clear

understanding for how trading will be approved and should commence. At the furthest end of the spectrum, Pennsylvania and Ohio provide general information and guidance. Finally, the explicit application or limits of trading differ between open and closed trading. Colorado, Connecticut, and Idaho clearly employ programs that are specifically targeted to achieve TMDLs. The remaining four states either explicitly allow for or fail to mention restrictions to trading in unimpaired and non-TMDL established waters.

Many of the models are state-level policies developed in response to growing interests in WQT alternatives and drawing from previous experiences with watershed-based programs. Others models, such as Ohio and Pennsylvania, are proactive in response to immediate or likely developments of trading initiatives. Connecticut is unique in that the state allocates significant funding to environmental initiatives; thus, CDEP was able to implement a joint facility upgrade and trading program to address specific nitrogen-related problems.

Evaluating the adequacy or success of each approach becomes quite difficult, however, due to differences between states' water quality goals and, more importantly, the lack of informative trading activity. Connecticut qualifies as the most successful program in terms of actual performance due to the straightforward program design and the stringency its regulatory driver, the Nitrogen TMDL. In contrast, Michigan's rigorously detailed rules, which allow point and non-point source participation, trading of various pollutants, and open and closed trading, have not realized notable success. No trades of any kind have occurred since the passing of rules in 2002 and the MDEQ is unable to adequately implement or modify the program. Of the remaining five programs, Idaho being the least recent (2003), no new trades have occurred under state-issued frameworks which contribute to an analysis. Nevertheless, much can already be learned from the development processes and designs of state-level approaches to date.

Table 2. COMPONENTS OF STATE TRADING POLICIES AND FRAMEWORKS

State	Type of Trading Authority	Require Individual TMDL/Permit Provisions	Define Allowable Scenarios	Describe Suitable Pollutants	Define Certain Trade Prohibitions	Specific Liability Provisions
Colorado	General	x	x	x	x	x
Connecticut	Legislation[15]		x	x		x
Idaho	Rule[16]	x	x		x	x
Michigan	Rules	x	x	x	x	x
Ohio	Rules[17]	x	x	x	x	x
Oregon	General	x	x	x	x	x
Pennsylvania	General		x	x	x	x

State	Baseline Establishment Methods	Describe Credit Generation Methods	Define Credit Quantification Methods	Limit Duration of Credit Use	Address Uncertainty or Equivalency	Allow/ Encourage Unconventional Offset Methods
Colorado	x	x	x		x	x
Connecticut					x	
Idaho	x	x	x	x	x	
Michigan	x		x	x	x	x
Ohio	x		x	x	x	x
Oregon	x	x	x		x	x
Pennsylvania	x		x	x	x	

State	Require Public Registry of Trade Activities	Public Access, Notice, or Participation	Monitoring & Reporting Requirements	Reference to Anti-Degradation	Reference to Anti-Backsliding	Program Assessment Mechanism
Colorado	x	x	x	x	x	x
Connecticut		x[18]	x			x
Idaho	x	x	x			
Michigan	x	x	x	x		x
Ohio	x[19]	x	x	x	x	x
Oregon	x[8]	x	x	x	x	x
Pennsylvania	x	x	x			x

[15] A general permit defines the requirements of trade participants; however, only statutory elements of C.G.S. §§22a-521 through -527 are indicated in Table 2.

[16] ID.A.P.A. §58.01.02.054.06 specifically allows pollutant trading within TMDL and equivalent processes, but does not provide further language or details.

[17] Ohio's proposed framework for developing trade rules is referenced in Table 2.

[18] No public access, notice, or participation provisions are expressly written in the trading provisions, but are otherwise required by NPDES permit and Nitrogen Credit Advisory Board reporting requirements. C.G.S. §22a-524(2) also requires proposed equivalency factors for POTWs to be made available for public review and comment.

[19] Participants are not required to submit information to a trading registry *per se*, but the responsible agency will maintain a publicly accessible website containing up-to-date information of trade activities within the state.

CHAPTER 3

THE GEORGIA SETTING

Water Quality

Georgia's water quality is injured by both point and non-point source pollution. Point source discharges are extensively regulated through permitting and only constitute a minor portion of total impairments. Instead, water quality is considerably degraded by insufficiently managed non-point source pollution. Draft 305(b) documents released by Georgia Environmental Protection Division in March 2006 signify an overwhelming number of surface waters not fully supporting some designated use as a result of non-point pollution or urban stormwater runoff (GEPD, 2006). The major criteria violated are fecal coliform bacteria, dissolved oxygen and biota. Although not specifically indicated in the draft documents, these impairments are often the result of nutrient and sediment loading from urban, suburban, and rural landscapes and untreated wastewater from such sources as leaking septic tanks. As of April 2006, every major river basin in the state has a developing or completed TMDL for fecal coliform and, except for the Tallapoosa River Basin, a dissolved oxygen TMDL as well (GEPD, Date Unknown (c)). Nutrient and sediments are

Despite the prominence of unabated non-point sources, accomplishing needed reductions from regulated point sources is also problematic, both in terms of meeting or maintaining water quality standards and ensuring continued economic and population growth. Examples of these issues are seen in the Savannah River Basin and in major reservoirs across the state. The GEPD currently has an informal moratorium on new discharges to the Savannah Harbor Area (S. Salter,

electronic communication, January 20, 2005) despite the need for greater wastewater discharge capacity in growing sections of the municipality. Furthermore, nutrient limits for six major reservoirs have been established in Georgia Comprehensive Rules and Regulations §391-3-6-.03(17), which demand effluent reductions by point source dischargers. The implications of these and other regulatory issues for water quality trading are further discussed in a later section of this chapter (see "Current Trading and Research Activities").

The occurrence of numerous non-point source related impairments and regulatory complexities for point sources does not indicate an ineffectiveness of current efforts. Nevertheless, understanding existing regulatory and legal frameworks can signify how WQT can potentially address the lingering water quality issues and how the supplementary tool corresponds with these efforts. The following section describes the various regulatory and non-regulatory approaches Georgia agencies take to protect water quality in the state. These principles will then be coupled with principles previously discussed in this thesis to formulate recommendations for developing a state water quality trading framework.

Key Water Quality Statutes

Water Quality Control Act (O.C.G.A. §12-5-20, et seq.)

The Water Quality Control Act establishes the statutory basis for regulating the quality and quantity of surface waters in Georgia. Section 12-5-21 requires the "treatment of sewage, industrial wastes, and other wastes prior to their discharge." Also under this section, the Georgia Environmental Protection Division is authorized to regulate sources by requiring "the use of reasonable [treatment] methods after having considered the technical means available for the reduction of pollution and economic factors involved to prevent and control the pollution of the

waters of the state." General authority is further provided for the development of rules and regulations that can be applied across the state, within particular areas of the state, or to specific pollutants (O.C.G.A. §12-5-23). The subsections of §12-5-23 list many of the key aspects of Georgia's water quality management program, including, but not limited to, the authority to establish water quality standards and administer permitting programs.

Georgia rules adopted pursuant to the Water Quality Control Act are promulgated under Ga. Comp. R. and Regs. §§391-3-6-.01 – .24. A key stipulation in these rules is the state antidegradation policy, which describes the minimum protection guidelines for Georgia waters. The policy, outlined in §391-3-6-.03(2), declares:

> (b)(i) *Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected*.
>
> (ii) Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, *that quality shall be maintained and protected unless the division finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the division's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located*. In allowing such degradation or lower water quality, the division shall assure water quality adequate to protect existing uses fully. Further, *the division shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control*.
>
> (c) Outstanding National Resource Waters (ONRW). This designation will be considered for an outstanding national resource waters, such as waters of National or State parks and wildlife refuges and waters of exceptional recreational or ecological significance. *For waters designated as ONRW, existing water quality shall be maintained and protected*.
>
> (I) No new point source discharges or increases in the discharge of pollutants above permitted level from existing point source discharges to ONRW shall be allowed.

(ii) Existing point source discharges to ONRW shall be allowed, provided they are treated or controlled in accordance with applicable laws and regulations.

(iii) New point source discharges or expansions of existing point source discharges to waters upstream of, or tributary to, NRW shall be regulated in accordance with applicable laws and regulations, including compliance with water quality criteria for the use classification applicable to the particular water. However, no new point source discharge or expansion of an existing point source discharge to waters upstream of, or tributary to, ONRW shall be allowed if such discharge would not maintain and protect water quality within the ONRW. (Emphasis added)

The antidegradation policy limits certain changes of discharge amounts to particular waters of the state. Where new or expanded sources are permissible, an antidegradation review is necessary. These reviews help determine if a lowering of water quality is justifiable as determined by antidegradation policy stipulations (GEPD, 2004a).

Similar to the protection of Outstanding National Resource Waters (ONRW), the quality of waters designated as "wild" or "scenic" must be maintained at natural levels (§§391-3-6-.03(6)). Furthermore, subsection 15(a)(I) of the same article prohibits temperature elevations in primary trout streams, which are state waters that support self-sustaining trout populations. According to rule §391-3-6-.06(4)(d)(ii)(4), new and modified permits are subject to federal antibacksliding provisions in Clean Water Act §402(o) (see chapter one). As noted in rule §391-3-6-.06(8)(d), the issuance of any permit does not 1) convey any property right or 2) the right to injure personal rights of others.

Erosion and Sedimentation Act (O.C.G.A. §§12-7-1 – 22)

The Erosion and Sedimentation Act was first passed in 1975 and has been amended several times since, most recently in 2003. The Act allows local governments to develop and implement ordinances for regulating land disturbing activities beyond the minimum requirements

of federal construction permitting regulations (see below). Regulated activities can include, among other things, clearing, grading, and excavating of land. Under local ordinances, governments can issue Land Disturbing Activity permits for these regulated activities. The most commonly regulated activities are associated with urban and suburban development since general agricultural and forestry practices are exempt under §12-7-17.

In addition to permitting provisions, the Act establishes minimum buffer requirements (§12-7-6(15)), which are distances land disturbing activities must maintain away from state waters. Distances of 25 feet must be maintained for most practices adjacent to warm waters and 50 foot buffers are required for activities adjacent to trout streams as defined in Ga. Comp. R. and Regs. §391-3-6-.03(15). Variances to these requirements may be granted; though, GEPD is the only entity authorized to make such decisions.

River Basin Planning Act (O.C.G.A. §§12-5-520 – 525 (1992))

In 1992, the GEPD commenced an assessment and planning initiative for each of the 14 major river basins in the state. The River Basin Planning Act obligated GEPD to work with local advisory committees, or basin advisory committees (BAC), in the development of each plan. Section 12-5-522 required for each river basin management plan, at a minimum, the inclusion of 1) a description of the physical and hydrologic characteristics of the watershed, 2) a listing of the governmental units with jurisdiction within the basin, 3) an inventory of land uses and all point and non-point sources of pollution, 4) a description of the plans goals, and 5) a description of the strategies that will be employed to obtain those goals. At least one public hearing is required before the final adoption of any plan. Once completed and adopted, all subsequent permitting and management activities conducted within a basin must be coherent with that basin's

management plan (§12-5-524(d)). The initiative ended in 2004 with the conclusion of the 14th plan, the Tennessee River Basin Management Plan (GEPD, Date Unknown (b)).

Comprehensive State-wide Water Management Planning Act (O.C.G.A. §§12-5-520 – 525 (2004))

The completion of the 14 river basin management plans led to more extensive considerations in the Georgia Code. The Comprehensive State-wide Water Management Planning Act, passed in 2004, requires the development of a comprehensive plan for managing quality and quantity of state water resources on a regional scale with particular emphasis on how the two aspects are interrelated. A Water Council, composed of elected officials and political appointees, was established under the Act in order to direct the development of the comprehensive plan and to approve the final form before consideration by the state legislature. The Act also requires extensive local and regional stakeholder involvement during the development phase as well as coordination among governmental units at the local, state, and federal levels.

Presently, GEPD is investigating the suite of policy tools available to address complicated resource issues in addition to developing a policy framework that addresses identified gaps in current management approaches. The four key focus areas include: 1) minimizing withdrawals; 2) maximizing returns; 3) meeting instream and off-stream demands; and 4) protecting water quality (GEPD, Date Unknown (a)). A final draft of the plan is due in 2007 to the Water Council. Should this plan not be ratified by the Georgia General Assembly, the Assembly must pass a statutory plan in lieu there of.

Planning Act of 1989 (O.C.G.A. §12-2-8)

Local governments are encouraged to develop comprehensive plans to manage growth and provide for the needs of their citizens. Authority to develop comprehensive plans and regulate land use is given to local governments by O.C.G.A. §36-70-3. Pursuant to O.C.G.A. §50-8-3, the Georgia Department of Community Affairs (GDCA) is directed to provide technical and planning assistance to local governments for the development of such plans. In conjunction with GDCA's efforts, GEPD is authorized under O.C.G.A. §12-2-8 to develop minimum environmental criteria to be incorporated into the plans.

Criteria developed by GEPD, codified into Ga. Comp. R. and Regs. §391-3-16, include minimum standards for protecting water supply watersheds, groundwater recharge areas, wetlands, river corridors, and mountains. Although minimum standards are non-regulatory, local governments must incorporate them in order to meet Minimum Standard requirements of the state ("Introduction", §391-3-16). Furthermore, GEPD will not issue water withdrawal permits if local governments have not adopted minimum water supply watershed protection standards. Other sections of the rules such as wetland and river corridor protection are largely ignored throughout the state due to a lack of regulatory inducements (K. Farrell, personal communication, April 19, 2006), but some incentives to incorporate minimum standards may be created through state and federal program funding requirements. Minimum standards for water resources typically include suggested buffer areas for variously sized watersheds as well as standards for development regarding impervious surface area and septic system design. Local governments are required to adopt the listed measures at a minimum, but are authorized to employ more stringent requirements.

Regulatory Programs

NPDES Permitting

Georgia administers a state NPDES permitting program pursuant to the Water Quality Control Act and subsequent provisions in Ga. Comp. R. and Regs. §§391-3-6-.01 – .24. These rules outline the specific requirements for obtaining and complying with applicable point and non-point discharge permits. The key permitting programs GEPD administers include:

- Individual and general NPDES discharge permits for point sources (§§391-3-6-.06 and .15, respectively);

- NPDES stormwater permits for individual municipalities and general permits for industrial sources and construction activities (§391-3-6-.16); and

- Pretreatment permits for indirect discharges to POTWs (§391-3-6-.08).

Individual permits are issued to sources such as industrial facilities and POTWs that discharge wastewater directly to state waters. GEPD requires local governments to develop comprehensive watershed plans when a new or expanded wastewater treatment facility is proposed. These plans must indicate strategies the local government will employ to address current water quality issues and methods to prevent future impairment (GEPD, 2004a).

Non-stormwater general permits are issued to qualified sources with similar pollution discharges. Typically, these are divided by industrial sectors in certain geographic areas. Stormwater permits for municipalities and industrial sources are required under federal Phase I

and II stormwater regulations and ensure that mandated management practices are employed to abate stormwater runoff. General construction stormwater permits are required for all construction projects that disturb one or more acres and are issued for three different project categories: stand alone, infrastructure, and common development. Construction permit applicants must submit an Erosion, Sedimentation, and Pollution Control Plan in addition to paying permit fees. Lastly, facilities that pretreat their effluent must comply with federal pretreatment standards so as not to interfere with the normal operations and treatment processes of POTWs. These facilities must integrate their discharge activities with the treatment capacity and overall treatment plans of the public facilities they discharge to.

Erosion and Sedimentation Permitting

The Erosion and Sedimentation Act allows municipal and county governments to take charge of permitting activities at the local level. If local governments do not administer local programs, then sources are only subject to requirements of the state general NPDES permit. Rules section 391-3-7.09 describes the process and minimum criteria necessary for GEPD to authorize local governments as Local Issuing Authorities (LIA). Local Issuing Authorities may develop more stringent ordinances than state requirements and are responsible for issuing Land Disturbing Activity (LDA) permits. Ordinances issued by LIAs can require more rigorous management practices, larger buffer requirements, and additional permit fees. In order to obtain LDA permits, applicants must develop management plans which outline the measures taken to prevent the escape of sediment from the disturbed area. Proper installation and maintenance of BMPs are the basic requirements for permit compliance.

TMDL Development

Pursuant to section 303(d) of the federal Clean Water Act, Georgia must develop TMDLs for waters that do not fully support a designated use. The GEPD works in conjunction with local stakeholders and Regional Development Centers (RDC) to identify specific solutions to water quality impairement (GEPD, 2004a). Of particular concern when developing TMDLs are pollutant allocations between point and non-point sources. Waste load allocations, when applicable, require effluent reductions from point sources and are regulated through NPDES permits. Load allocations define necessary reductions from non-point sources; although, these sources are mostly unregulated in Georgia and reductions are often achieved through voluntary programs.

The USEPA and GEPD together wrote 860 TMDLs for water segments impaired by various pollutants between 1997 and 2003 (GEPD, 2003). Although some progress toward delisting waters has occurred, the number of impaired waters continues to increase as monitoring efforts identify more impaired segments expand.

Funding Programs and Non-Regulatory Initiatives

As described earlier, point sources are regulated through NPDES permits and are required by law to either meet the effluent standards or implement the management practices defined in their permits. When existing sources are faced with more stringent requirements, funding becomes a critical issue. The cost of compliance for non-public sources is the sole responsibility of that source, where as public entitities can receive financial assistance through state and federal programs.

Conversely, achieving reductions from unregulated non-point sources in Georgia requires monetary incentives. Voluntary programs administered by GEPD, Georgia Coastal Resources Division (GCRD), Georgia Forestry Commission (GFC), and the Natural Resource Conservation Services (NRCS) supply the main thrust for non-point source pollution reduction and prevention in the state. These entities use public funds to provide technical and financial assistance to unregulated sources in order to encourage implementation of best management practices and other pollution abatement or prevention efforts.

Since the premise of water quality trading is cost-effectiveness under regulatory constraints, conventional funding alternatives can significantly affect the viability of trading markets and certainly warrant mention. Furthermore, policy decisions on the use of public funds in WQT markets are necessary in the future development of a state trading policy. Current funding programs to help reduce point and non-point source pollution are described below.

State Loan Programs

With few exceptions, domestic wastewater treatment facilities in Georgia are publicly owned. When upgrades are necessary to meet more rigorous standards, public facilities rely on fees assessed to customers as well as funding from state-administered grant and loan programs (GEPD, 2004a). The most notable programs are administered by the Georgia Environmental Facilities Authority (GEFA), which include the Georgia Fund and the Clean Water State Revolving Loan Fund (CWSRF). Both of these provide low interest loans to local governments for sewer, stormwater, and wastewater infrastructure upgrades. The Georgia Fund is financed solely by state bond revenues and is annually allocated to GEFA by the state legislature (J. Bodwell, personal communication, April 18, 2006). Although the Fund is principally a loan

program, a one-time grant up to $100,000 is available to small local governments for the installation or expansion of a public sewer system (GEFA, 2006). The CWSRF, established under Title VI of the federal Clean Water Act, provides federal capitalization grants for states to administer programs similar to the Georgia Fund (USEPA, 2006b). Georgia must match the federal grant portion with at least 20 percent state funds (e.g., for every federal dollar, Georgia must add 20 cents). An interesting aspect of the federal program is the ability to disburse loans for a variety of non-point source abatement projects. In Georgia the application of this funding option has been limited to funding stormwater BMPs (J. Bodwell, personal communication, April 18, 2006). Should reliable trading markets develop within Georgia, there could be a potential to direct CWSRF assistance through POTWs for the purchase of least-cost reductions alternatives (i.e., WQT). Most likely, the current employment of CWSRF assistance weakens the demand for trading alternatives.

U.S. Environmental Protection Agency- Section 319(h) Grant Program

Amendments to the federal Clean Water Act in 1987 created the Section 319 Nonpoint Source Management Program, which provides grants to state programs that offer "technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific non-point source implementation projects" (USEPA, 2006a). This funding, along with NRCS agricultural grant programs, provides the greatest amount of funding for non-point source abatement and the two combined currently represent the chief modes for achieving TMDL load allocations. Georgia meets CWA §319(h) requirements to administer a state program and has disbursed approximately $4.2 million per year for the past three years to qualified recipients on a competitive basis. Since the primary

goal of the program is to address non-point source impairments, 303(d) listed waters are given highest priority (J. Linzer, personal communication, April 18, 2006). Examples of projects eligible for funding are numerous, but often include education and outreach initiatives, demonstration projects of best management practices, and even assistance for water quality trading pilot projects. Projects in the Conasauga River and Lake Lanier watersheds may be of particular interest to future trading efforts due to their focus on measuring BMP effectiveness.

Natural Resource Conservation Service- Conservation Funding Programs

The NRCS is a division of the U.S. Department of Agriculture responsible for providing technical and financial assistance to land owners and managers for the conservation of natural resources, including water (USDA, 2006a). The NRCS, through Georgia's Soil and Water Conservation Commission, administers the Environmental Quality Incentives Program, which was established under the 1996 Farm Bill. The federal program provides cost-share incentives for agricultural producers to voluntarily implement best management practices. Cost-share grants can be as much as 50 percent of the average cost for approved practices and are targeted in areas with critical water quality problems. Agricultural producers with various types of farm land are eligible for participation and can enter into 5-year or 10-year contracts with NRCS, which requires the producer to maintain agreed upon practices in order to receive assistance (GEPD, 2004a).

Two other funding opportunities are offered through the Conservation Reserve and Conservation Security Programs (managed by the USDA Farm Services Agency and NRCS, respectively). These programs provide rent payments to land owners that have historically instituted conservation-friendly practices as well as cost-share incentives for instituting greater

conservation measures. The programs differ in that the former is related to land retirement and the latter to land that will continue to be used for agricultural production (USDA, Date Unknown; USDA, 2002).

The EQIP program has greater relevance to WQT because it involves new non-point source reductions, which are subsequently applicable to TMDL load allocations or other similar limits. In terms of equity for agricultural sources who implement BMPs prior to the establishment of WQT markets, the Conservation Reserve and Security Programs provide equitable compensation for their efforts. Additional efforts by the Soil and Water Conservation Commission Districts and the University of Georgia's Cooperative Extension Service play an integral role in increasing the implementation of best management practices on private lands (GEPD, 2004). Although these initiatives are limited to research, education, outreach, and technical assistance, they may be relevant to the promulgation of future trading efforts involving agricultural participants.

Coastal Non-point Source Pollution Management Program

The Coastal Non-point Source Pollution Management Program is a subset of initiatives under the Georgia Coastal Management Program. Both the coastal program and the non-point source portion were established by the federal Coastal Zone Act Reauthorization Amendments and the subsequent Georgia Coastal Management Act (O.C.G.A. §12-5-320 – 331). These programs are administered by the National Oceanic and Atmospheric Administration and the Georgia Coastal Resources Division (GCRD) at the federal and state levels, respectively. Under their statutory authorities, GCRD oversees the non-regulatory Non-point Source Pollution Management Program in 11 coastal counties of Georgia. The objectives of this program are to

reduce non-point source pollution from unregulated sources through local governance and educational programs. A significant part of the non-point program is providing incentive grants to qualified local governments and educational institutions for the implementation and administration of voluntary programs that carry out select pollution management measures (GCRD, 2003; GCRD, 2004; GCRD, 2006).

Georgia Forestry Commission

Similar to agricultural uses, forested lands and associated practices are exempt from permitting requirements of both the Water Quality Control Act and the Erosion and Sedimentation Act. In 1981, the Georgia Forestry Commission (GFC), in partnership with other entities, developed plans for implementing forestry BMPs; however, the use of these practices is voluntary and no financial incentives to implement them are provided by the state. Part of GFC's duties includes complaint investigations of forestry activities. If inspections identify a violation of Water Quality Control Act prohibitions, then the Commission will turn the complaint over to GEPD for further enforcement. Finally, forestry practices are semi-controlled through a licensing program by the State Board of Registration for Foresters, which can revoke or deny permits renewals to foresters who have unresolved complaints regarding water quality violations (GEPD, 2004a).

Current Trading and Research Activities

County and Municipal Trades to Date

Trades, of sorts, have already occurred in Georgia. Newnan, Cobb, and Cherokee counties as well as the City of Savannah have administered waste load reallocations between

POTWs in static and dynamic sections of growing communities (S. Salter, electronic communication, March 14, 2005). The City of Savannah executed trading between multiple sources in response to an informal moratorium of new discharge permits to the Savannah Harbor watershed. The following paragraph further details the situation as described by Susan Salter of GEPD (electronic communication, January 20, 2005).

In order for a new POTW (Crossroads) to be constructed in the otherwise fully-assimilated harbor, discharge capacity for biochemical oxygen demand, total suspended solids, and ammonia was transferred from an older facility (President Street) to the new one. An industrial point source within the watershed simultaneously changed its operations from a direct discharge to an indirect pretreated discharge; this allocation was also transferred to the new Crossroads facility. Since the President Street facility wanted to maintain its permitted flow limit and the industrial waste water necessitated further treatment, the Crossroads facility was required to treat its effluent to higher standards.

In essence, the Savannah trades resemble a sole-source offset as defined in chapter one. Although this example is relatively straightforward and did not involve the exchange of credits in a market-type system, it does represent a move toward increased allocation efficiency and it might exemplify how trading will continue to occur in the future. Furthermore, it demonstrates how GEPD can use its current NPDES permitting authority to oversee trading between point sources.

University of Georgia Research

The 2006 Georgia 303(d) Draft Report (GEPD, 2006) lists four segments of Lake Allatoona as violating the Chlorophyll *a* criterion. To date, only a TMDL Evaluation has been

completed for one section of the north-Georgia lake (GEPD, 2004b). In response to this listing and nutrient limits currently in place under Ga. Comp. R. and Regs. §391-3-6-.03(17)(d)(ii), investigators at the University of Georgia are exploring opportunities for phosphorus trading between point and non-point sources within the lake's watershed. The established limits and future TMDL waste load allocations serve as the potential regulatory drivers for a WQT market. Ultimately, the study seeks to determine whether point/non-point source trading is viable (UGA, Date Unknown).

A key portion of the project is determining the background phosphorus and sediment loadings from agricultural non-point sources as well as the reductions obtainable through best management practices. Despite knowledge of BMP implementation costs, in Georgia as well as nationwide a void still exists in quantifying specific load reductions from such practices (M. Risse, personal communication, April 21, 2006). University of Georgia researchers intend to alleviate this disparity through watershed monitoring and modeling. The model will serve as the primary tool for calculating the relative water quality benefits achievable from various sources throughout the watershed and developing empirically-based trading ratios that accurately reflect equivalent reductions. The latter stages of the three year project entail a cost analysis of point and non-point source reductions, a comparison of multiple market structures, stakeholder advisory meetings, and an educational trading conference and workshop (UGA, Date Unknown).

Georgia State University Research

Researchers at Georgia State University (GSU), have been investigating water quality trading alternatives in Georgia for several years. The first major initiative analyzed the feasibility of nutrient trading in the Upper Chattahoochee Watershed (Rowles, 2004). Trading

analysis was focused around Lake Lanier and West Point Lake, both of which exhibit nutrient enrichment problems and have nutrient limits set by GEPD rules. Despite the requirement for point source reductions under the nutrient limits, a watershed-modeling study indicated that the majority of phosphorus loading originates from non-point sources. This scenario creates a potential impetus for point/non-point source trading.

In the introductory discussion of her 2004 working paper, Rowles discusses issues relevant to state policy, including, but not limited to, additionality, credit banking and pollution rights. She explains, as have other researchers, that "additionality" is the concept of limiting marketable credits to "[pollution] reductions that would not have occurred in the absence of trading" (p. 14). Thus, non-point source credit production begins: 1) after a TMDL load allocation or other reduction limit has been met, and 2) over and above reductions previously generated with §319 or NRCS funds. Rowles disregards the notion of credit banking, which was previously examined by her colleagues at Georgia State University, Cummings et al., in 2003. She notes the use of this instrument is not well demonstrated and has the potential to cluster pollution loadings during certain periods. The final issue, pollution rights, is a key criticism by adversaries of environmental trading market. Rowles questions the validity of arguments that suggest market trading implies property rights for dischargers given that some "right" is always granted to sources unless there is a zero-discharge requirement. The distinction between constrained rights to pollute and marketable property rights remains to be settled by Georgia courts.

Overall, the Upper Chattahoochee study was inconclusive as to whether trading would be a viable alternative; although, Rowles noted that many conditions present within the watershed theoretically are conducive to WQT markets. The most notable points of the study were the

questions left unanswered regarding aspects of the environmental, economic, and political contexts. These 11 remaining research questions identified lay a clear foundation for future analyses:

- Analysis of legal authority;
- Availability of nonpoint source credits;
- Timing of point source upgrades;
- Analysis of the costs of phosphorus control;
- Estimation of phosphorus loadings from nonpoint sources;
- Development of watershed model to support WQT;
- Potential for trading with urban nonpoint sources;
- Potential for cross-pollutant trading;
- Analysis of joint products;
- Displacement of nonpoint source loadings; and
- Potential for market exit/entry effects. (p. 52).

The second and latest initiative entails a much broader research agenda. Working papers released in 2005 describe the first two completed portions of a multiphase research project. Rowles (2005) analyzed the feasibility of trading in all 14 major watersheds of Georgia using five evaluation criteria developed in the 2004 Upper Chattahoochee study. These criteria, which indicate whether conditions within a watershed are conducive to trading include: environmental suitability (of a pollutant), sufficient regulatory and economic incentives, participant availability, and stakeholder response. The analysis indicated that current regulatory limitations do not create

sufficient incentives for WQT. She surmises that future development of nutrient criteria for Georgia waters, as encouraged by USEPA, could lead to greater demand for trading alternatives. Moreover, a considerable tightening of regulatory limits is necessary to produce cost-differentials supportive of trading between point sources of variable size or between point and non-point sources. A final undetermined variable noted by Rowles is stakeholder response, which may or may not be an additional inhibition to trading in Georgia based on the level of their acceptance and participation.

The most recent working paper of the project, Rowles and Thompson (2005), examines the suitability of WQT to current legal frameworks in Georgia. Some of the key state and federal legal frameworks contained in this thesis are noted by Rowles and Thompson as are many of the same state policy models. Of particular interest, though, is their discussion of state constitutional and case law and their implications for trading.

First, is the discussion of the state constitutional provision of Ga. Const. Art. III, §VI, Para. VI (2004), which prohibits the state from "[granting] any donation or gratuity or [forgiving] any debt or obligation owing to the public." Rowles and Thompson correlate the use of this provision in water-use permitting debates to NPDES permitting scenarios. They suggest that the lack of NPDES permitting fees for point sources could lead to a gratuity from the state should any remunerations be received. However, this is not likely to be an issue as water quality trading in Georgia will probably be driven by sources seeking to pay for less expensive reductions instead of entrepreneurial sources selling their excess discharge capacity on an open market. Nevertheless, the issue has not been reviewed by Georgia courts and the implications for WQT are still undetermined.

Another key legal issue discussed was a Georgia Supreme Court decision regarding the state antidegradation policy of the time. In *Hughey v. Gwinnett County*, 278 Ga. 740 (2004), the Court ruled against the issuance of an NPDES permit to Gwinnett County for a new WWTF stating it violated the antidegradation provision that required "the utilization of the 'highest and best practicable [level of treatment] under existing technology to protect existing beneficial water uses'" (p. 22). Although this decision had implications for how technology-based standards would be regulated throughout the state, subsequent changes to the rule section in 2005 altered future applications. At the time of writing this thesis, the equivalent clause of the antidegradation policy reads, "the division shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources" (Ga. Comp. R. and Regs. §391-3-6-.03(2)(b)(ii)). This recent amendment allows broader interpretation of the antidegradation policy and is likely to pose fewer inhibitions to trading since technology-based standards are no longer articulated.

From their legal analysis, Rowles and Thompson reiterate their conclusions that insufficient regulatory drivers currently limit trading. Georgia laws do implicitly authorize water quality trading; though, the authors insist that the development of a statewide policy prior to any substantial trading activity in the state would be premature. They maintain instead that observing demonstration or pilot trading projects in Georgia watersheds would improve state policy development. Remaining portions of the GSU project may provide further insights to Georgia-specific issues. These portions entail a cost-estimate for point source treatment alternatives, development of a trading simulation model in one Georgia watershed, a monitoring study to inform point/non-point source trading ratio development, and a concluding stakeholder workshop.

Summary of the Georgia Setting

Georgia waters exhibit significant levels of impairment as a result of point and non-point source pollution. Some types of the latter source are inadequately regulated and contribute considerable portions of total pollutant loads to state waters, including the pollutants most frequently traded, nutrients and sediments. Water quality trading could be an effective tool for achieving needed non-point source reductions. Clearly Georgia's current legal structures support the development and implementation of a state water quality trading policy. Trades of any sort would need to comply with water quality standards and permit requirements pursuant to the federal Clean Water Act (TMDLs), the Georgia Water Quality Control Act, and the Georgia Erosion and Sedimentation Act. In addition to requirements under these laws, minimum standards and management plans set by the Planning Act of 1989, the River Basin Planning Act, and its successor, the Comprehensive Planning Act of 2004, would undoubtedly influence baseline requirements for various pollution sources. Upgrades for POTWs and non-point source BMPs funded through public programs currently play a vital role in meeting load allocations, but warrant further consideration for their function in Georgia trading schemes.

Evidence to date suggests that regulatory limitations are not yet conducive to trading in any of the major Georgia watersheds. Furthermore, much remains to be learned about the viability of non-point source participants, which are essential to trading programs in Georgia. Current efforts by University of Georgia researchers may reveal viable opportunities for trading between point and non-point sources as well as a better understanding of how to develop accurate, cost-effective trading ratios. Despite uncertainties in the future of WQT in Georgia, the remaining sections of this thesis discuss the alternatives for developing an appropriate state trading framework.

CHAPTER 4

POLICY RECOMMENDATIONS

At the very least, water quality trading entails three interrelated aspects: environmental, economic, and political. Governing agencies should consider the effects new policies will have on the environmental efficacy and economic efficiency of trading initiatives in order to make it a viable compliance mechanism. While agencies such as GEPD have a primary statutory obligation to ensure pollution sources achieve and maintain acceptable water quality, it can still institute practical policies that enhance the capacity of trading alternatives. Thus, Georgia policy-makers must address several critical questions when seeking to develop a state trading framework that simultaneously advances the goals of pre-existing legal institutions, adheres to the requirements and standards of those structures, and pays respect to the underlying economic and political implications. The following sections of this chapter outline step-wise considerations of trading policy alternatives for Georgia.

Initial Questions

Is it Time?

An analysis of literature and available state models first draws into question the current need for a state policy. Evidence presented by Rowles (2004) and Rowles (2005) indicates that extensive policy development would be premature at this time. Not only are regulatory limitations insufficient to create significant demand for trading in key watersheds, but independent exploration of trading opportunities is minimal across the state. Nevertheless,

similar conditions are seen in other states which do exhibit a state trading framework. Unfortunately, the lack of trades under these examples hinders an extensive evaluation. Proactive employment of policy frameworks has still enabled states to accomplish several noteworthy goals. These goals include the dissemination of critical information to interested parties, productive cooperation and communication between stakeholders, and a standardized process for approving trades.

The decision for Georgia policy-makers to not broach the development of a state policy at this time does not necessarily impede the ability of sources to participate in limited trading activities. This is illustrated by the waste load reallocations already seen in several Georgia communities. Should point sources continue to pursue waste load reallocations, GEPD has the authority to modify discharge permits accordingly. Exchanges of waste load allocations between POTWs within the same municipality would not necessarily constitute a market; although, markets with actual transactions could develop between municipalities within a common larger watershed. Similar trades between industrial point sources and POTWs or pre-treatment sources and POTWs may also be feasible within the existing context. Despite GEPD's permit-modification authority, several limitations are presented by the lack of a specific trading policy.

The primary limitation is the exclusion of non-point sources, which typically are necessary to maximize the flexibility and cost-efficiency of WQT alternatives. Furthermore, trading schemes that incorporate non-point sources provide an additional mechanism for managing the widely unregulated sources. Evidence to date suggests that cost-differentials are not sufficient to warrant trading between regulated point sources and agricultural non-point sources, but more sophisticated economic analyses by University of Georgia researchers could indicate otherwise and strengthened regulatory limitations in the future could increase the

differences. Secondly, an official state framework provides needed guidance to potential participants and regulatory agencies as a whole. Clear understanding of how trading activities may commence with respect to state and federal legal requirements can decrease initial transaction costs by streamlining the trade development process. Furthermore, a policy framework will decrease administrative costs for GEPD by enabling them to administer previously outlined and consistent decisions. Lastly, an openly developed and promulgated framework will increase the political viability and public acceptance of proposed trading activities. Considering these points and the fact that all trades naturally involve several legal aspects, it is reasonable to suggest that some level of state policy development is necessary as interest in the alternative continues to grow.

What Framework is Best?

It is probable that the greatest demand for WQT in Georgia will arise from the need to comply with TMDLs or lake nutrient limitations and to facilitate continued growth in watersheds with fully-allocated assimilative capacities. Based on current trends, the pollutants of greatest concern will be nutrients, sediment, and bacteria. Although more time is still needed to show which alternatives emerge as most effective, alternatives are compared below for a policy approach that is relevant to these Georgia-specific context assumptions and that provides the essential functions of WQT institutions first proposed in chapter one. Again, those include, with an asterisk to the functions most applicable to a state policy framework:

- Define marketable reductions; *
- Communicate among buyers and sellers;

- Ensure environmental equivalence;*
- Define and execute trading process;*
- Track trades;
- Assure compliance with relevant federal, state, and local requirements;*
- Manage risk among parties to trades;* and
- Provide information to stakeholders.*

The first alternative is statute-authorized, state-facilitated trading. While some states have authorized the exploration or use of trading through statutes, Connecticut is the only one to actually authorize a fully functional program at the state level and in fact, has realized substantial success toward the achievement of nitrogen reduction goals. Despite such progress, the approach may have limited applicability for Georgia where large river basins discharge to multiple receiving basins, public funding for POTW upgrades is more limited, aggressive TMDL implementation is not present, and a variety of non-point source pollutants are the greatest cause of water quality impairment. The critical component to Connecticut's success has not been trading itself, but rather the large annual designation of public funds for WWTF upgrades. Indeed, trading is merely a crutch for the greater nitrogen reduction program.

The isolated availability of trading to POTWs has removed the need for more developed trading policy content. Consequently, this specific model does not adhere well to the essential functions presented earlier. A more complex framework is necessary, then, to address the diverse set of water quality issues facing Georgia's large watersheds. However, one potential application of the Connecticut model is the use of watershed general permitting, which is authorized in Georgia by the Water Quality Control Act (O.C.G.A. §12-5-23). Although the use

of watershed general permits for point sources would depend on circumstances beyond the scope of WQT development, such permits could serve as a foundation for trading schemes. The use of watershed general permits for point source discharges has not yet been utilized in Georgia.

The second approach is adoption of detailed trading rules. In theory, this extensive process can provide a strong legal foundation for managing WQT activities across the state and provide precise guidance for participants and agencies alike. This alternative is consistent with the first in that it builds upon legislative authority already available to a state.

Ohio is currently in pursuit of this approach to support future OPEA administration. However, the only model actually in place to date is Michigan, which has experienced negative consequences from its detailed approach. Strict provisions have stifled the flexibility of trading markets by creating requirements that are overly complicated and difficult to implement. The ability of the program itself to be flexible is impeded by an arduous process for reviewing and modifying rules coupled with the recent lack of designated funding for program administration. Certainly, the concept areas described in Michigan's rules are informative and useful; however, the amount of limitations and lack of flexibility created are perhaps counterproductive.

The Georgia Environmental Protection Division could also take this approach using general authorities vested in it by current legislation. Based on the lack of trading activity to date within the state, however, it is likely an unwise venture for GEPD at this time. Despite the apparent lack of success in Michigan, adopting specific rules for Georgia may still be a preferred alternative in the future once more is understood about how parties will develop trading schemes in the state and how much GEPD intends to invest in the administration of such activities.

The final approach, a general policy framework, is far less restrictive and is perhaps more applicable to Georgia's current environmental and legal context. As seen in the majority of state

models, a general policy framework informs potential participants of the standard protocols agencies will follow to approve trades. These protocols are founded in pre-existing legal frameworks presented by state and federal water quality laws and the subsequent regulatory or management programs. Primarily, general policy frameworks offer an informational resource and at a very minimum define the means for fulfilling many essential functions of a WQT institution. This approach gives considerable latitude to participants for the design of market structures on various scales (i.e., watersheds to river basins) and also enables them to organize individual trades if no formal market exists. Further benefits of this approach include sustained administrative flexibility as well as minimal up-front investment and subsequent administrative costs for state agencies. General frameworks typically do not create significant responsibilities for agencies beyond the current programs they implement and are much easier to amend when necessary to adapt to changing political environments or when new data and information that effect WQT become available.

Although some initial transaction costs can be reduced by making policy guidance available, the onus is still on pollution sources to seek-out other participants and engage them in transactions. As a result, a significant drawback of this approach is the lack of facilitation costs absorbed by the state. Given the current level of trading activity in Georgia, however, providing such flexible alternatives is essential to enabling the development of marginal trading opportunities. A general policy framework that entails basic functions (e.g., WQT concept information, specific legal considerations, and general stakeholder responsibilities) is the most suitable alternative for Georgia at present.

How Should Policy Development Proceed?

Since WQT has profound environmental, economic, and political implications, the development of any state policy should occur in an open forum with extensive public and stakeholder input. This process has been emphasized by most of the seven states and is in-line with existing federal requirements concerning other activities such as NPDES permitting and TMDL development. Georgia's current context provides an obvious venue for facilitating such discussions. Early stages of the Comprehensive State-wide Water Management Planning process involve the examination of multiple policy tools, possibly including WQT. Consultation by advisory committees at the statewide and river basin levels can undoubtedly clarify the interest in and practicality of a statewide trading policy. Furthermore, these groups can help identify specific issues of concern and areas of trading application on a sub-state scale. Before that occurs, however, proposed discussion groups and workshops of the Georgia State University and University of Georgia research projects may begin the necessary dialogue for trading in the state.

Similar to the situations in other states, many of critical issues identified in Georgia are not likely to have legal foundations or precedents and will warrant a unique policy stance by GEPD. Drawing from the final conclusions of Georgia research initiatives and other related discussions, Georgia policy-makers could proceed with the development of an interim or draft framework. Subsequent public hearings and comment periods will be necessary to improve policy decisions and increase the political acceptability of any contentious framework provisions. This stepwise development process (informative demonstration project—initial discussions—policy development and draft release—public review and comment period—final policy release) is commonplace among the state models and could be a useful process for Georgia, too. The

following sections describe difficult issues identified from previous initiatives that require ample stakeholder input and should be addressed through a public review and comment process.

Sensitive Policy Issues

Property Rights

GEPD rule §391-3-6-.06(8)(d) (see chapter 3) unmistakably dispels suggestions that discharge permits afford any property rights. Accordingly, any source that holds a discharge permit should forfeit the ability to exchange their allocation with other sources upon cessation of operation. For example, the waste load capacity permitted to the Hercules industrial facility in the Savannah Harbor watershed was forfeited once they changed to a pre-treatment operation. Their discharge capacity did not become a sellable commodity, but rather added assimilative capacity that was then reallocated to the new Crossroads POTW by GEPD. While application of the property rights definition is clear in this example, further clarification of its application to exchanges between continuously permitted sources is necessary. Policy provisions that require dissolution of credits, such as those expressed in Oregon's Internal Management Directive, are appropriate for illuminating the point.

When credits are exchanged between point sources, the purchasing source is not inherently buying the right to pollute, but rather purchasing the legally-mandated level of reduction at a lower total cost. Similarly, credits generated from excess pollution reductions should either be directly paid for by the purchasing source or marketed by the seller only to recover its reduction investment. The property rights issue becomes much more contentious in the case of waste load reallocations and non-point source reductions. GEPD rule §391-3-6-.06(8)(d) and the gratuity clause of the state constitution (Ga. Const. Art. III, §VI, Para. VI

(2004)) create an implicit prohibition to marketable exchanges of waste load reallocation when no net reductions are acquired. Thus, natural limitations exist for sources that want to "buy in" to fully-allocated assimilative capacities. Municipalities and industrial facilities with unused capacity will be reluctant to freely give up their ability to grow. The additional capacity allocated to the Crossroads plant from the President Street POTW presents a unique situation because it was essentially an internal reallocation by the City of Savannah. In order to achieve a no net increase of pollution, new sources can still find alternatives such as non-point source abatement to supplement technology-based treatments.

As for non-point sources, a lack of regulatory or permit requirements provides certain rights to choose land-use practices, including those that result in some level of pollution. Consequently, non-point sources have the ability to sell any reductions they produce through improved management practices. However, when non-point sources enter into contracts with government entities for funding assistance, which are intended to achieve progress toward TMDL load allocations, they may forfeit certain rights in terms of sellable pollution credits. This very issue should be clarified through final GEPD policy decisions, which determine the eligibility of reductions made with public funds.

Use of Public Funds

The ability to generate sellable pollution credits from practices funded by CWSRF, §319, and NRCS cost-share grants is controversial because it allows entities to meet regulatory requirements at the expense of the general public, (a.k.a., "double-dipping"). This "double-dipping" is an issue of fairness between sources and can also be related to the issue of property rights discussed above. If sources are allowed to sell credits generated with public funds, then an

unfair advantage is provided over those who cannot acquire such assistance. A better way to apply funding from these programs to trading schemes is to: 1) allow POTWs to use low-interest loans from the CWSRF to purchase credits at a lower cost, which means lower payout from public accounts yet still full repayment; 2) apply §319 monies to development of trading programs such as that done in the University of Georgia Lake Allatoona Project; and 3) allow conventional NRCS funding programs to reward agricultural producers with good stewardship histories.

Beyond the problem of "double-dipping" is that of "additionality." As illustrated in chapter two (see "Ohio"), using publicly funded credits would not provide additional progress toward TMDL load and waste load allocations. However, this argument may not apply where TMDL load allocations are fully met and trading could provide additional incentives for waste load reductions. In either case, it is necessary to decide whether public funds should provide private benefits and in the case where load allocations have not been met, it must be determined whether allowing the use of these credits would dilute TMDL initiatives. In Georgia, the use of public funds may specifically call into question the gratuity clause of the state constitution; although, its limitations may not apply to federal funds.

There are mixed stances among the state models on this issue. Michigan is the only state that directly prohibits the use of §319 and other public funds due to political concerns about "double-dipping." Conversely, Pennsylvania explicitly allows the practice if: 1) the funding source does not articulate specific restrictions, and 2) all sellable credits are created beyond the applicable baseline. Pending final policy decisions, Ohio may also allow similar practices in order to encourage reductions that might not otherwise occur without trading.

Fairness to Historically "Good Actors"

In trading schemes, the marginal cost principal often leads to greater benefits for non-point sources that pollute more because they can easily abate a larger amount of pollution than sources who historically implement good management practices. In the case of a bilateral exchange market, credit buyers tend to seek out non-point sources with greater pollution problems in order to increase their cost-efficiency. Unfortunately, this bias cannot be easily addressed in the context of a general policy framework that only outlines legal considerations. A clearinghouse market structure may be one solution because it allows all sources to contribute (i.e., sell) credits equally; however, this requires a substantial investment in oversight and management. Regional officials in Ohio maintain that other programs such as the NRCS Conservation Reserve and Security Programs fill the niche of compensating land owners that are historically "good actors." Although, this issue may be raised during policy discussions and reviews, WQT is not an intrinsic mechanism for rewarding non-point sources who generate reductions, but rather is a tool for allowing regulated sources to meet their defined limitations. Georgia may choose to pass-off related concerns of fairness to the design of particular trading programs, clearly explain the available alternatives for compensating "good actors", or invest in the implementation of a statewide clearinghouse. The latter option may be inappropriate at this time and could place limits on the type of trading that may develop in the state. It will be important for policy-maker to inform concerned parties of the difference between the state's guidance role through a policy framework and the role of individual market structures to further address equity issues.

Final Allocations and Pre-TMDL Trades

Pre-TMDL trading could occur in Georgia where utilized to achieve some other limitation (e.g., nutrient limits for major reservoirs). Trades conducted in impaired waters prior to the establishment of a TMDL are subject to nullification if the final allocation requires further reductions from trade participants. Consequently, failing to set allocations with respect to pre-TMDL trades removes incentives for participants to create early reductions via trading.

Three states provide notification of these potential risks in their trading frameworks. Colorado and Ohio encourage trade participants to become engaged in the TMDL development process in order to create workable allocations that recognize early reduction efforts. Although Oregon's IMD does not provide any indication that pre-TMDL trades will be incorporated into final allocations, it, along with the other two state policies, warns that trades may be invalidated if previously achieved reductions are not sufficient to meet required standards. Georgia and trade participants both stand to benefit from cooperating during the development of TMDL allocations, which ultimately determine credit production baselines. In developing a policy framework, Georgia policy-makers should include provisions that do not discourage early reductions via pre-TMDL trading. Solidifying this incentive could be accomplished either by adjusting the final allocation for individuals with approved trades or by allowing trades to be applied toward a general baseline.

Mechanisms for Addressing Uncertainty

Several mechanisms for addressing trading uncertainties are proposed throughout the seven state models, especially that which is associated with non-point sources. Examples of these mechanisms include uncertainty and equivalence ratios, reserve pools, and water quality

contribution factors. Ratios are the most commonly utilized mechanism throughout the state models. Except for Connecticut and Michigan, all finalized state policies express the need for some ratio other than 1:1, but allow specific measures to be developed on a case-by-case basis. The requirement for sources to purchase credits at a ratio greater than 1:1 or provide some additional credit contribution creates further costs and ultimately influences the effectiveness of trading. Certainly, policy-makers must evaluate the need for such mechanisms to ensure adequate water quality protection, but they should consider balancing this responsibility with the associated economic repercussions.

If ratios are deemed suitable for ensuring trading equivalence and certainty in Georgia, then a state framework can leave the development of specific ratios open to case-by-case determinations, require specific or certain types of ratios, or describe the minimum standards for their use. The trade-offs between each alternative include development costs for the state or potential participants as well as the level of equivalence precision each ratio achieves. Provisions that demand a specific or certain type of ratio necessitate further distinction because ratios can either be empirically-based or estimated. Empirically-based ratios use monitoring data to accurately quantify loading levels from particular sources and the reductions achievable through certain abatement practices. This accuracy provides the ability to set ratios that are both environmentally effective and cost-efficient, which translates into a more equitable allocation of costs and reduction responsibility. The drawback to empirically-based ratios is the time and expense associated with their development. An example of this expense is the multi-year study of agricultural non-point source loadings in the Lake Allatoona watershed. Furthermore, variations in watershed characteristics necessitate alterations of calculated quantities or

additional monitoring studies. However, as Stephenson et al. (1998) suggest, the use of land-use models can allow quick and simple modifications that produce watershed-specific calculations.

In contrast to empirically-based ratios, estimation ratios are relatively arbitrary in nature and are more customary in trading programs across the country. Obvious advantages to estimation ratios include: modest upfront investments for development, ease of implementation, and they provide net environmental benefits if established conservatively. However, such ratios are likely to be either too conservative or too liberal, which can lead to considerable margins of error in environmental benefits and pricing of abatement costs.

Other alternatives for addressing uncertainty such as reserve pools and water quality contributions add substantial transaction costs and are not likely to be economically viable mechanisms. Water quality contributions, also described as retirement ratios in Pennsylvania's interim policy, raise the issue of fairness for regulated sources. While ratios are essential to compensating for uncertainty, the mechanism requires sources to acquire even more reductions than mandated by their permits. This over-requirement is necessary to some degree, but requiring further water quality contributions is not economically or politically sensible.

Georgia policy-makers will probably receive contrasting viewpoints on what mechanism is appropriate. Thus, it is important for them to consider how much investment is warranted in developing precise adjustment mechanisms, what extent of environmental assurance is practical, and what economic repercussions uncertainty mechanisms will likely have on trading markets.

Non-point Source Compliance

Many non-point sources, especially agricultural, are insufficiently addressed under Georgia's current management framework. Thus, it will be useful to involve such sources in

trading markets when they can help achieve mandated reduction goals. Where unregulated, the effective management of their participation requires some mechanism that ensures compliance with agreed upon terms. The least intrusive policy alternative is allowing point sources, which are constantly bound to their permit requirements, to ensure proper non-point source compliance through private agreements. This approach can reduce non-point source stakeholder concerns regarding imposed regulation or state encroachment on land-use practices. Private contracts and third-party agreements can serve as the binding mechanism.

Should GEPD require more involved oversight of non-point sources, then provisions that authorize admittance to private property for verification may be necessary. As this approach will undoubtedly meet resistance from agricultural and silviculture producers, coordination with soil and water conservation as well as forestry commission personnel may be needed to garner stakeholder trust. Actions to ensure non-point source compliance should resemble current working relationships between county extension agents and private land owners for programs such as the NRCS Conservation Reserve and Security Programs.

Trading Framework Integration and Content

Integration Into Current Legal Frameworks

Water quality trading is implicitly supported by Georgia laws in the same manner policy frameworks are supported in the examined states. Additional strengthening of regulatory limitations may be necessary to create a greater demand for trading, but no changes to current statutory or regulatory structures are necessary to facilitate the development of a state trading policy. A policy framework that fulfills the essential functions emphasized above and assimilates into current state efforts is appropriate for Georgia at this time. For maximum

relevance and ease of implementation, GEPD should develop a policy that integrates trading with current NPDES permitting efforts and appropriately incorporates non-point sources through previously described mechanisms. Non-regulatory efforts conducted by the Georgia Forestry Commission, the Soil and Water Conservation Commission, and the NRCS can provide invaluable technical assistance to trading initiatives involving non-point sources; although, considerable coordination will be necessary to combine the dissimilar approaches of GEPD and those non-regulatory entities. Current upgrade and abatement funding opportunities provided by the Clean Water State Revolving Loan and Georgia Funds, Section 319(h), and Farm Bill programs may create further disincentives for trading unless channeled in unconventional ways or deemed appropriate for credit production. Specific mention of applicable state and local standards should also be included in framework provisions to clarify which standards are requisite to baseline establishment and water quality protection. A trading framework that parallels current efforts will significantly decrease the level of investment needed to develop and implement state policies as well as reduce any unfamiliarity with the new alternative for state entities and participants alike.

Content

In addition to the most appropriate format (e.g., a general policy framework), the specific content provided is critical to accomplishing the essential functions. Each of the following sub-topics have been highlighted or described throughout this thesis and, along with any others identified in the future, constitute the key policy features that should be addressed in a state framework. They include:

- Definitions and descriptions of relevant legal and environmental concepts;
- Suitable and prohibited pollutants for trading;
- Sources eligible for trading;
- How credits can generally be produced or suitable activities for credit production;
- Appropriate units of trade (e.g., pounds per unit time);
- Credit duration or "life" (e.g., contemporaneous with use or banked for future use);
- Allowable trading circumstances (e.g., open and/or closed trading);
- Spatial or trade design limitations (e.g., to achieve reductions and protect local water quality within a watershed);
- Suitable methods for addressing equivalency and uncertainty;
- Participant accountability mechanisms (e.g., NPDES permit or contract enforcement);
- Liability for each participant and requirements to show compliance;
- Administrative and enforcement roles of GEPD;
- Methods or requirements to integrate and comply with other state and federal programs;
- Mechanisms to allow public participation and access to information; and
- Mechanism for reviewing, evaluating, and amending state trading policies.

Specificity

The final consideration for developing a state trading framework is the level of specificity to be included during the initial versions. Specificity, or the degree of detail, can positively affect the level of understanding for stakeholders and the public, but can also create the opposite effect by instituting excessive limitations. Examples of specificity choices include: 1) requiring the use of a specific ratio type *versus* requiring certain standards for trade equivalence, or 2)

defining the suitable types of trades or pollutants *versus* opening-up the alternative to any activity that can clearly demonstrate the potential to achieve water quality improvements.

Michigan represents one extreme with great detail and specificity whereas Pennsylvania represents the other, with broad policy statements. Michigan Department of Environmental Quality officials attribute the lack of interest in WQT to the high level of detail and the numerous requirements and limitations presented by their rule provisions. Conversely, Pennsylvania Department of Environmental Protection officials have obtained many suggestions from stakeholders to provide more detail in the next iterations of their state trading policy. Thus, it is reasonable to surmise that a balance between the two, such as that seen in Colorado, Idaho, Ohio, and Oregon is appropriate for Georgia. Furthermore, it is likely that greater detail is preferred in the context of a policy framework than in rules because a policy framework would not entail further legal requirements beyond those already required by state and federal statutes. The degree of specificity can progress throughout the stakeholder discussion and iterative framework development processes.

CHAPTER 5

CONCLUSIONS

Summary

Abundant literature and case studies are available regarding water quality trading in the United States. This literature focuses on theories for optimizing individual program elements and case-specific factors of many watershed-based programs. Indeed, there is a multitude of program and market-design alternatives to choose from. However, when considering trading policies on a statewide scale the issues grow much more complicated and there are very few policy models to draw from. States encompass a variety of environmental, economic, and political variables within their diverse watersheds; thus, implementing an effective and consistent WQT policy requires a broad, yet flexible policy mechanism.

The approaches taken by the seven states presented in this thesis are also quite variable, ranging from trading statues to general policy guidance. No matter what level of detail or state involvement, a common feature seen in each state model is the implementation of a policy or other mechanism that is integrated with pre-existing legal and regulatory frameworks pursuant to the federal Clean Water Act, state water quality protection laws, and local ordinances. Even newly created rules or statutes, which carry the weight of law, similarly direct trading programs to adhere with other pre-existing legal standards.

Georgia's current legal structures are quite similar to those exhibited by each of the seven state models. Although evidence to date indicates there are insufficient incentives for trading, GEPD holds a limited ability to manage trades between permitted sources. Impending studies by

Georgia State University and University of Georgia researchers will likely lead to better estimates of WQT viability. Interest in trading alternatives is likely to grow relating to bacteria, nutrient, and sediment pollution, which constitute the major causes of water quality impairments across the state. Although considerable policy development by GEPD is not currently warranted, new evidence or changes in regulatory limitations could reveal a demand for trading.

Conclusions

As interests grow and sufficient incentives develop, GEPD and stakeholders both stand to benefit from the institution of some state-level guidance and oversight. Since Georgia has adequate authority and a supportive legal framework for implementing a trading policy, what is left to decide is: whether a state issued policy is necessary; what scope and particular legal mechanisms are appropriate and best; what process will allow GEPD to develop a relevant and widely accepted policy; and what specific contents should be included? The suite of policy alternatives presented by the seven state models present a variety of options; however, these should be approached with some caution since statewide programs are in their infancy and, with the exception of Connecticut, have experienced few trades that indicate best alternatives.

Should Georgia decide to broach a state water quality trading framework, it is clear that one must be consistent with pre-existing legal frameworks, flexible enough to allow innovation at the watershed level, and provide clear direction on the associated legal and procedural considerations of trading. Furthermore, the framework design and components can have a profound impact on the environmental efficacy and economic efficiency of trading. Policy-makers should consider provisions that balance both aspects. In order to accomplish this, GEPD

should work with public participants and stakeholders across the state to identify issues applicable statewide and those that are river basin specific.

A general trading policy framework, which clearly outlines the applicable legal and environmental considerations, is most appropriate for Georgia until further developments in trading activity occur. This type of framework will allow GEPD to uniformly manage trading activities within the context of current regulatory and non-regulatory efforts. Several sensitive policy issues are also associated with trading schemes and should be debated through an open public process. Nevertheless, more time is still needed to identify the variables specific to Georgia as well as which policy alternatives are best suited to achieving regulatory goals and improving the cost-efficiency of compliance.

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